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SCIENCE COMING INTO ITS OWN
A GIANT JUNK YARD

# SCIENTIFIC AMERICAN

*A Weekly Review of Progress in*

INDUSTRY · SCIENCE · INVENTION · MECHANICS

SPEEDING UP THE LAYING AND LIFTING OF RAILROAD RAILS.—[See page 23]

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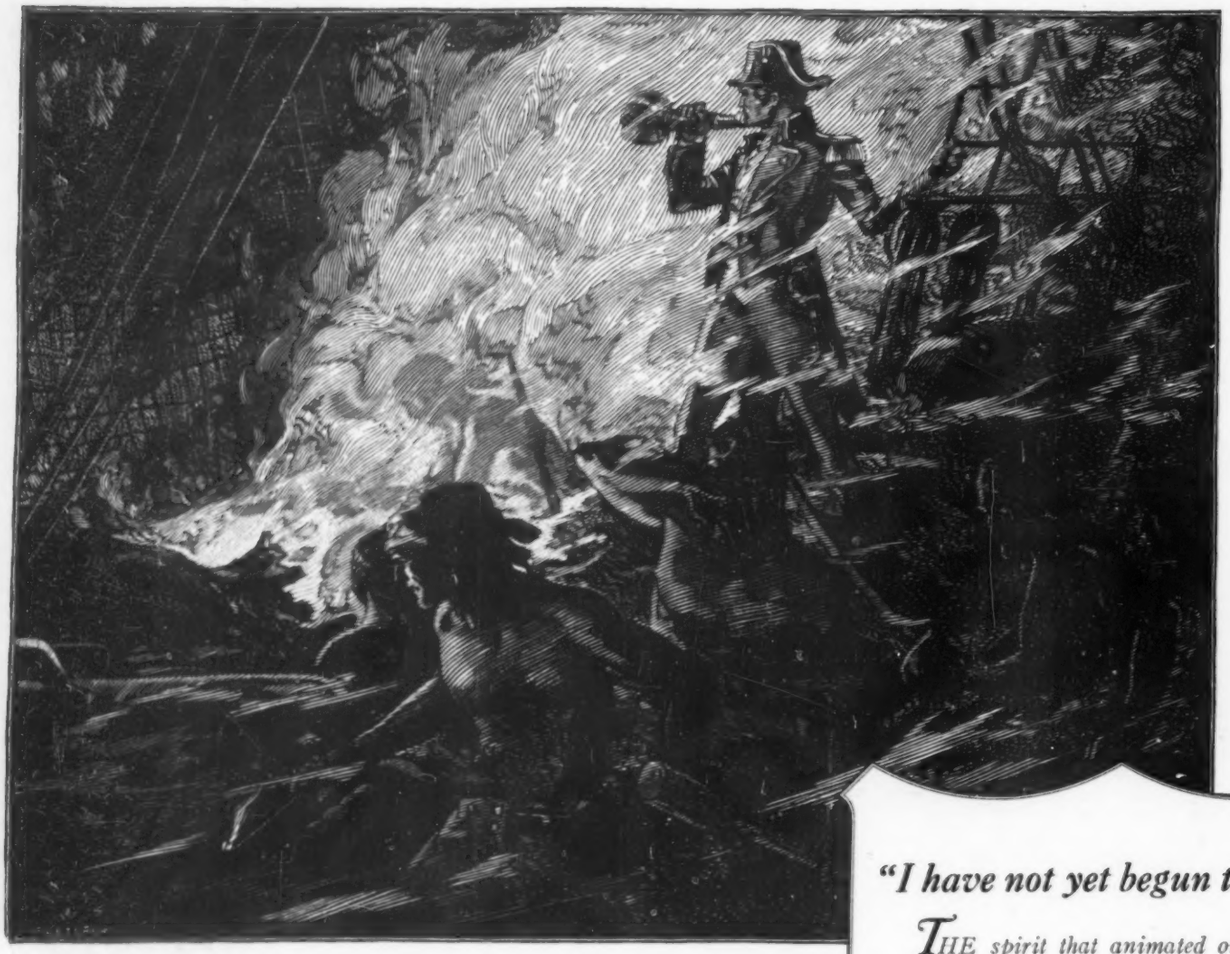

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# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXV. NUMBER 2 ] NEW YORK. JULY 9, 1921 [ 15 CENTS A COPY 20 CENTS IN CANADA

Photos, A. E. Wells

*Upper view:* U. S. S. "Oklahoma" firing a broadside off Guantanamo. *Lower view:* The "Oklahoma" salvo as seen from the towing ship. Every one of these shells would have been a hit against a battleship. The target was entirely demolished and the salvo straddled in the most perfect manner from a gunner's standpoint.

**Close-up view of recent Navy target practice—(See page 25)**

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## A Noble Presidential Precedent

FIVESCORE and seven years ago, the Secretary of State of our young republic penned a notable letter to the American Minister in London. So filled was this letter with noble purpose, so rich with statesmanlike vision that we should like to see it cast in bronze or graven in stone and set up as a permanent memorial in the legislative halls of Congress. The letter, written by Monroe in the year 1814-1815, was as follows:

"The information you give of orders having been issued by the British Government to increase its naval force on the lakes is confirmed by intelligence from that quarter of measures having been actually adopted for the purpose. It is evident, if each party augments its force there with a view to obtaining the ascendency over the other, that vast expense will be incurred, and the danger of collision augmented in like degree. The President is sincerely desirous to prevent an evil which it is presumed is equally to be deprecated by both Governments. He therefore authorizes you to propose to the British Government such an arrangement respecting the naval force to be kept on the lakes by both Governments as will demonstrate their pacific policy and secure their peace. He is willing to confine it on each side to a certain moderate number of armed vessels and the smaller the number the more agreeable to him; or to abstain altogether from an armed force beyond that used for the revenue. You will bring this subject under the consideration of the British Government immediately after the receipt of this letter."

The letter was duly received and considered, and out of it arose that too-little-known but momentous treaty called the Rush-Baget Agreement, according to which both the United States and the British Governments agreed to limit their naval armaments on the Great Lakes. On Lake Ontario each Government was to maintain one vessel not exceeding 100 tons burden, equipped with one 18-pound cannon; on the upper lakes each was to maintain two vessels of the same burden and armament, and one on Lake Champlain. All other armed vessels on the lakes were to be dismantled, and no other vessels of war were to be thereafter built or armed.

You may search all the records of diplomacy as far back as diplomacy has existed and find no single act that displays broader wisdom or greater moral courage, or that has been more prolific of beneficial results. Judged as an act of statesmanship it has been pronounced the highest achievement of the English-speaking races. That this pacific move, made by the President of the United States immediately at the close of a bitterly-contested war, has been fruitful in the way that he suggested it would be, is proved by the fact that the two greatest powers of the world, the United States and the British Empire, have lived in peace for over 100 years, although their adjacent territories, for a sheer stretch of 4,000 miles, have not a fort or a cannon or a soldier to guard their frontier on either side.

Today, at the close of another great war, in which the two nations have fought, not against each other, but as staunch allies against a common foe, a similar overture has been made, this time by the Government to which Secretary Monroe addressed his letter of 1814. The overture has come, it is true, not in the form of a diplomatic letter, but rather as an open declaration of attitude or policy made in Parliament by the British Premier. Speaking of the desire of Great Britain to cooperate with the United States in its world policies, particularly in the matter of armaments, he declares:

"We look confidently to the Government and people of the United States for their sympathy and understanding in this respect. Friendly cooperation with the United States is for us a cardinal principle; dictated by what seems to us the proper nature of things; dictated by reason quite as much as by instinct and common sense. We desire to work with the great republic in all parts of the world. We desire to avoid the growth of armament, whether in the Pacific or elsewhere. We are ready to discuss with American statesmen any proposal for limitation of armaments which they may wish to set out."

Different from Monroe's letter of 1815 in its wording, but identical in its spirit and purpose, is this pronouncement by Great Britain upon the question of world policies and armaments. But, the people of the United States are thoroughly in favor of limitation of armaments, and their representatives in Congress have notified President Harding, or shortly will do so, that this is the expressed sentiment of the people. Our President therefore, is in a position to produce, on a world-wide scale, those same beneficent results which sprung from that letter of one of his predecessors written fivescore and seven years ago. The President, however, for certain reasons which he does not disclose, seems to hesitate in making any definite move toward calling a council for the adjustment of this stupendous question. Meanwhile, naval construction is going full blast in the navy yards of the world, and it would seem to many, probably to most of the American people, that this delay, for whatever cause it may be, is endangering a great cause. The two other leading naval powers have expressed themselves through their most prominent statesmen—for Japan has made announcements equally authoritative with that of Lloyd George—as being heartily desirous of meeting the United States for a discussion of the question of armaments.

The delay in this vital world matter is to be laid at our own door. Why do we hesitate? It cannot be that the President is awaiting a mandate from the country—its voice in favor of conciliation around the green table is unanimous and unmistakable. It has been suggested that the Government knows of certain disturbing facts in the International situation of which the public knows nothing. Well, if so, is it not better to settle such matters now, over the table, than later in a bloody war?

## How Fast Do Birds Fly?

EVERYONE surely who has watched the flight of the swifter birds has, now and again, made his own estimate as to the speed at which they sweep by. The speeds attained by the carrier pigeon, the duck and the faster of the sea birds have formed the subject of endless guesswork and inevitable exaggeration. Birds which are incapable, even when at full stretch, of doing more than 40 to 50 miles an hour, have been credited with 100 and over; and we remember reading somewhere the serious statement by a man who was both naturalist and huntsman, that when he was lying in wait for ducks he had more than once seen a flock of geese pass overhead across a certain measured stretch of landscape, that must have been going at least 120 miles an hour—and this in still air.

Now the fact of the matter is that nothing is more difficult than to judge of the speed of any object through the air by mere human observation. Foreshortening due to perspective alone renders it impossible to tell just when a moving object passes above some fixed point on the ground, and almost invariably the estimated speed is far beyond the actual. At the present time the highest well-authenticated speed is that of homing pigeons, some of which have reached a speed of 60 miles an hour over comparatively short distances.

But now comes Colonel R. Meinertzhagen, a noted ornithologist in Great Britain, who has recently published some data on this subject in the *Ibis*, which is the leading English journal devoted to bird life. The colonel states that during his anti-aircraft duties in the course of the war, he trained his men in instrumental work by making them take observations of the flight of birds. These he collected and then confirmed their results by instrumental work himself. He tells us that the speed of birds, as thus accurately ascertained, is far below what it is popularly believed to be, varying from 20 to 40 miles for the smaller passeres to from 40 to 50 miles an hour in the case of waders. Those speeds represent steady flight; but when a bird is frightened by an enemy, or when it is pouncing upon its prey, it can accelerate greatly for a limited time. He estimates that for a short distance the swift can reach a speed of 100 miles an hour.

The airplane, therefore, has greatly surpassed the swiftness of the birds both in its power of sustained speed and in its maximum speed. From 100 to 120 miles an hour can be maintained by many of the standard machines, and we know that last year the racing speed was carried up to from 180 to 190 miles per hour.

Where the birds still greatly surpass the human flying machines is in the matter of taking off and alighting. The seabirds, and all birds in fact, by changing the angle of incidence of their wings, are able to reduce their landing speed at a rate which the airplane and the seaplane cannot at present approach.

## Important Patent Legislation

IT is probably not known to many inventors that the laws of many foreign countries require a patent obtained in those countries to be worked there within a certain time limit which is determined by the statute. It is considered by many that this requirement works a hardship to American inventors, in that the inventor is supposed to establish an industry covering his invention in that foreign country, whereas, as is well known, no working time is set for anybody obtaining a patent in the United States.

Senator Stanley has introduced in the United States Senate a bill designed to remedy this discrimination. It provides that patents issued to persons not citizens of the United States shall contain a proviso to the effect that if such patent is not worked or put in operation so as to result in actual production of the article in reasonable quantities in the continental limits of the United States within the period of two years from the date of issue, the United States reserves the right to license any person, or persons, for purposes of manufacture, use and sale in the United States; and it fixes the royalties, the manner of payment and the penalty for failure to pay.

It should be borne in mind that when foreign patents are granted certain taxes have to be paid by the American inventor annually, and that the patent is forfeited in case these taxes are not paid, and furthermore, in certain countries, as stated above, in case the patent has not been "worked" in that country. Germany in particular has been very exacting in regard to the working of the patent within the limits of the Empire. It has now been found that the Krupps, of Essen, Germany, have recently filed a very large number of applications in this country, some 228 in all, and it is with a view of compelling the foreign inventor to establish an industry in this country that the legislation in question has been proposed.

It has been the policy of the United States to keep aloof from any such legislation as that proposed, or the paying of annual taxes. Of course there is a great deal to be said on both sides of the question, and it is hardly likely that the bill would have been introduced into the Senate were it not for the great number of applications which have been introduced by the Krupps. Furthermore, it is a grave question whether the proposed bill will accomplish the result for which it is designed. In the year 1909 a treaty was entered into between the German and the United States Governments in which it did not become necessary for an American applicant to work his invention in Germany. Of course, all the treaty obligations were laid aside by the war, but when peace is once declared it is highly probable that all the former treaties will be re-enacted or, at least, will come again into operation. If a law should then be passed under which burdens were imposed upon the German subject here which an American citizen is not compelled to meet in Germany, it is only fair to assume that a retaliatory legislation would be resorted to by Germany which would do away with any advantage that might be gained under the proposed law. This proposed change in our patent law would affect most severely Great Britain, France and other countries with which we were allied during the war, so that it is a grave problem whether the advantage sought after would be reached by passing the suggested legislation.

## Electricity

**A Canopy Switch.** — Packing a real snap switch mechanism into the confines of a small structure is a feat that has been successfully accomplished by a company manufacturing switching devices. The tiny switch is intended to fit into fixture canopies and plates, as well as the bases of portable lamps the dimensions of which must be kept small.

**Oil Conservators for Power Transformers.**—A leading electric company has developed an oil conservator which eliminates sludging as a result of exposure of hot oil to oxygen. Only in rare instances, so it is claimed by the manufacturing company, can any moisture condensation take place, and then it is absolutely confined to the conservator where it is trapped and may be drawn off without its coming in contact with the main body of the insulating oil, thereby greatly reducing the work of keeping the oil up to proper dielectric values.

**Precision Form of Kelvin Electrostatic Voltmeter.** —A paper read before the Institution of Electrical Engineers describes a form of electrostatic voltmeter for precision measurement. The instrument follows the general arrangement of the Kelvin type. The chief modifications are: (1) Very considerable reduction in weight, permitting (2) the use of a bifilar suspension to overcome the effect of elastic fatigue; (3) a modification of the shape of the needle to produce a more satisfactory "scale law" for both small and large deflections; and (4) the provision of various mechanical details to facilitate construction and adjustment.

**Electric Fans for Limousines.**—A manufacturer of small motors and fans has recently developed a special electric fan intended for use in the usual closed car and in ambulances. The main features of the fan are given as follows: The battery wires are 6 inches long, the bracket has a double joint with rigid set pins and several points, of adjustment for tilting the fan to any angle; the fan is easily fastened to the ceiling or any other part of the tonneau; with a few feet of connecting cord and a control switch placed at a convenient point in the line it is easily attached to the storage battery of the car; the current consumption while running is 1.5 amperes.

**Power Transmission at 220,000 Volts** is scheduled to become an accomplished fact in the near future, according to *General Electric Review*. Confidence in the attainment of this transmission voltage has long been inspired by the successful operation of 150,000-volt lines, but the actual construction of such an installation has been delayed by the diverting activities of war. Under such a degree of pressure the concentration of energy is so great that 100 horsepower could be transmitted by the filament in an ordinary 40-watt incandescent lamp without heating this minute conductor above its normal operating temperature or shortening its rated life.

**Electrification of Sweden's Railways.** — The Riksgransen Railway lies wholly within the Polar Circle, thus necessitating special appliances to contend with the snow. Except for the stations, the railway is single-line throughout, of standard gage, with a maximum grade of 1/100, and sharpest curve of 500 meters radius. The whole line is being electrified, according to *The Technical Review*, the power being supplied by water. On the electrified line trains of 40 mineral-carrying cars and brake van are hauled by two locomotives, which is an increase of 40 per cent, with a speed increase of 50 per cent over the original steam traction. Power is generated as single phase current at 80,000 volts, and stepped down in four substations to 16,000 volts on the overhead conductors.

**Atmospheric Electricity for Power.** — Mr. Hermann Plauson, on the basis of recently conducted experiments which were described in the SCIENTIFIC AMERICAN MONTHLY some months ago, is of the opinion that an inexpensive and unlimited supply of electrical energy may be obtained from the atmosphere. He has even published a book on the subject. As antenna he uses a captive balloon having a metallic cover provided with a large number of pointed projections or spikes, and allows it to ascend to a height of 1,000 or 1,600 feet above ground. Positive electricity is then collected from the air and transmitted to the ground through a wire rope fitted with sparking gap, which in turn produces an electric vibration in a circuit. M. Plauson obtained with one balloon at a height of 1,000 feet a supply of 17.28 kilowatt hours per diem, and with two balloons 91.6 kilowatt hours. He calculates that a battery of 10 balloons should give an annual supply of 210,000 kilowatt hours. The idea of extracting electricity from the air is not a new one, although nothing of a practical nature has been realized to date. However, it seems to be among the future possibilities.

## Science

**Esperanto in Italy.**—Esperanto has now been recognized by Italy as a "clear" language for telegraphic purposes, and is no longer considered as a cipher or "conventional" language.

**Again the Paris Platinum Thief.**—Platinum vessels used for chemical analysis and other apparatus, worth altogether $14,000, were stolen from the laboratory of the Prefecture of Police in Paris recently.

**Smokeless London.**—For once London is "spotless town" for now for the first time in centuries London can breathe and smell fresh air for the curse of soft coal is removed by the coal strike.

**Flies in New York.**—Owing to the fact that refuse must now be covered and that few other places are left to breed, the common housefly is becoming rather infrequent in the more settled part of New York but not in the outskirts. Many of the high class apartments no longer provide fly screens. Asphalt, concrete, and the covered garbage pail have done wonders in mitigating the evils of this pest.

**Ice in the Fairways of Commerce.**—Ever since the loss of the "Titanic" the U. S. has worked steadily to eliminate one of the twin highwaymen of the sea—ice. Old shipmasters say icebergs "carry no side lights," but with the aid of the wireless two of our cutters with headquarters at Halifax patrol the lanes and keep a close watch for the cold and beautiful bergs which have been found sixty miles below the usual zone of travel. The other twin—fog—cannot be watched and warded against.

**Annual Tables of Constants and Numerical Data.**— The publication of the Annual Tables of Constants and Numerical Data, Chemical, Physical and Technological, which was interrupted during the war, has now been resumed by an international commission acting under the authority of the International Union of Pure and Applied Chemistry. The volumes are quite expensive, and those interested should address the American Commissioner, Prof. E. W. Washburn, University of Illinois, Urbana, Ill.

**Appreciation by Mme. Curie.**—"I feel that I have three countries—the land of my birth, the land of my adoption, and the land of my new friends," Mme. Curie, co-discoverer of radium, said on sailing in expressing her appreciation of American hospitality during her seven weeks' visit here. "It is with much regret that I come to the last day of my visit in America," Mme. Curie said. "There has been only one disappointment, that has been my physical inability to do all the things I would wish to do and to meet all of the American people I much desire to meet. My work with radium, and especially during the war, has so damaged my health as to make it impossible for me to see many of the laboratories and colleges in which I have a genuine interest."

**A Classic Hoaxer Passes Away.** — Louis de Rougemont certainly gave Ananias, Munchausen, Dr. Swift and Sindbad the sailor an awful run. He has just died in a London pauper infirmary. It is extraordinary that a man of such wonderful imagination should have died in poverty. Even his real name was appropriate for his wholly untruthful career for it was Henry Louis Grin. Twenty-five or thirty years ago de Rougemont astonished the world by a series of yarns about savages and cannibals which made Defoe's masterpiece look tame. He claimed to have married a cannibal wife. His writings were accepted for a time and he even addressed the British Association on the habits of the Australian aborigines, but at last he was unmasked by an English newspaper and it was proved that he was working for a Swiss banker while he was astonishing the natives as a cannibal king.

**Fulton's Panorama Passes Away.**—A last memory of Robert Fulton passes from Paris with the destruction of the Café Vernon. There was still above the door, in the large bronze letters of another age, "Café des Panoramas," and the panoramas were built in 1799 by Robert Fulton. Says Stoddard Dewey in *The Evening Post*: "He had a patent for them, covering the improvement which he had made in the original invention. This he had purchased from Robert Barker of Edinburgh, who had the idea and realized it roughly twelve years before. It was a triumph of Yankee ingenuity and it pleased Napoleon, whom it helped in politics. Fulton had to go back to America after seven years of Paris to get his steamboat running, but his panoramas remained on the Paris boulevards until 1831 and the café for their patrons until now. There were two panoramas, one showing a view of Paris from the roof of the Tuileries and the other represented the Evacuation of Toulon by the French in 1793. Robert Fulton came to Paris to study art."

## Aeronautics

**Aviation School for Bolivia.** — There is a project on foot which has the approval of the Bolivian Government for the foundation in that country of an aviation school for the purpose of developing commercial flying and improving communication with adjoining countries. Included in the equipment of the proposed school will be hangars, mechanics' shops, photographic workshops, and other supplies.

**Paris to Warsaw.** — Beginning April 2nd an aerial post was put into operation between Paris and Warsaw. The airplanes start every Tuesday and Saturday at 8 A. M. Letters, post cards, periodicals, newspapers, commercial papers, samples of goods, ordinary and registered, may be sent by this post. The charge for letters from Warsaw is 30 marks to Prague, 60 marks to Strasburg, and 105 marks to Paris for the first 20 grams. These letters or parcels are received at the main post office from 8 A. M. to 8 P. M. and on the day of departure at 6 A. M.

**Dirigible Frame Metal.**—It is stated that scientists in a Pittsburgh steel mill have discovered a formula, long sought by British and American naval authorities, which the Germans used in the construction of frameworks of Zeppelin dirigibles. Hitherto nothing has been known of the composition of the aluminum alloy used in the framework of Zeppelins save that it was lighter than steel and of great tensile strength. It was determined that the strength of the metal lay in its treatment by heat, and scores of attempts were made to determine the proper temperature. The scientists, however, have discovered something else, essentially American, which will go into the new alloy.

**Kongo Airplane Service.** — It is reported that the directors of the Forminiere Diamond Mines Company have suggested the inauguration of an air service by seaplane, which would operate between the mines at Djoko Punda, on the Kasai (a tributary of the Kongo) and Kinchassa, on the Kongo—from which latter point the railroad runs to Matadinoki, a steamer port on the lower Kongo. The directors offer to defray the greater part of the initial cost of the scheme. In the meantime a survey of the route is being undertaken. The distance from Kinchassa to the mines is approximately 500 miles, which could be covered in two days, as contrasted with over a month by the existing river transport.

**The New Morane-Saulnier Monoplane.** — We learn from *Flight* that M. Saulnier, the well-known French designer, has just completed the designs for a large cantilever monoplane which is to have seating accommodation for 16 passengers, and will be driven by three Lorraine-Dietrich engines, of which two will be placed in the leading edge of the wings, after the fashion of certain German planes, and the third in the nose of the fuselage. The monoplane wing will have a span of 88 feet 6 inches, and the wing area will be 1,250 square feet. The weight empty has been estimated at 9,450 pounds, and the weight "all on" at 15,400 pounds. It is estimated that the machine will take off with two engines, and fly at 1,500 feet on one engine.

**Laying Mines by Means of Aircraft.**—A new method of planting mine fields, involving the use of aircraft and a special type mine equipped with a parachute, has been the subject of recent experiments conducted by the Navy in Chesapeake Bay, according to reports. The mine used is the invention of Charles Lee, a mechanical engineer of Portsmouth, Va. The mechanism, according to *Aerial Age Weekly*, consists of the mine, anchor, cable and silk parachute. Large numbers of airplanes, each carrying a supply of mines, can be sent over the area to be mined, and the devices dropped at regular intervals. The parachute eases the descent to the exact spot selected, and the instant the mine hits the water the parachute is detached and floats away to sink later.

**Altitude Cockpits.** — When considering altitude flights for commercial purposes, writers often lay considerable stress on the difficulties to be met in designing passenger cabins. Oxygen tanks, air-tight walls and temperature and pressure regulators are stipulated among others, states *Aviation and Aircraft Journal*, and great difficulties are foreseen in developing this equipment. Vane-driven air compressors, continues this authority, would probably obviate the use of oxygen tanks and a simple system of intake, exhaust and relief valves might take care of ventilation in the passenger cabin, which would have to be constructed with perhaps greater care to details than is usual. Exhaust gas heating, or electrical heating, comparatively easy to construct, would maintain a comfortable temperature in the cabin. Taken altogether, we are told, the difficulties to be met in providing for altitude flying appear to have been somewhat exaggerated.

*Left:* Heavy machine parts that have outlived their usefulness and have descended to the humble estate of scrap metal. *Right:* Cutting up steel plate to be returned to the furnace

**Some of the more bulky properties of the junk man**

# A Giant Junk Yard

## A Plant that Handles Anything from Discarded Battleships and Abandoned Railroads to Old Tin Cans

By William A. McGarry

IN these days of tremendously expanding industry the world's greatest engineers and scientists are engaged in a constant search for new sources of raw material, while thousands of experts devote all their time to the development of economics. Looking ahead ten, twenty, fifty or a hundred years, chemists and geologists and the big men in a dozen other lines toil to produce substitutes for everything from fuel to paper. Already the world is nearing the end of existing supplies of many raw materials, but somehow even the more far-sighted men of science and industry have expressed no fear of a metal shortage.

**Hundreds of miles of barbed wire that never saw France. It may be sold to farmers, and it may go to the Orient for the manufacture of ornaments**

On the surface this may appear to be a blunder. Man's uses for all the metals increase every day in number and extent. It is probable that the great bulk of all new patents call for the use of iron, copper, brass, tin or some other metal. In steel alone the production is so huge and the growth of the industry has been so tremendous that even in the face of deposits that seem inexhaustible one would expect the question, "What shall we do when the supply of raw material is gone?"

The answer is to be found in any metal-junk yard. It throws a new light on the value to civilization and progress of these products of the earth. For metal alone of all the raw materials wrested by man from the earth for use in building his cities, transporting his commerce and furnishing his pleasure and entertainment, never really wears out. Machines break down or are superseded by better ones, bridges collapse, ships become too old for service and boilers burst or become unsafe. But modern metallurgists — and countless thousands of workers steeped in the ancient lore and tradition of the iron worker but absolutely devoid of any scientific knowledge—can take the rusted, battered remains and turn out new lathes and locomotives, new rip-saws and razor blades, that will give first class service and "last a lifetime."

In a way the romance of metal is perhaps the nearest approach man achieves to the efficiency of nature on a large scale. The earth produces food and then utilizes the waste to enrich the soil for further food production. It is a chemist that never sleeps. Man imitates this cycle in salvaging textiles, paper and other materials for reuse in some other form, but nowhere is his percentage of success as great as in metal.

No one who has not inspected a great metal-salvaging plant can realize the extent of his success, or grasp its future possibilities. Officials of the Philadelphia company whose forty-acre riverside plant is said to be the largest in this country, admit that the business is really in its infancy. With a half century of experience in handling everything from scrap from tin-can factories to worn-out battleships, this firm is still developing new means of utilizing metal scrap that in former years went on the dump heap as valueless.

The plant is located on the banks of the Delaware River and is the largest of a half dozen yards maintained by this company. Half of its acreage is covered with every conceivable kind of metal junk, and several hundred thousand tons more are tied up to the piers in the shape of monitors, torpedo boats, worn-out ocean liners and other discarded vessels. Just inside the main entrance gate is a small mountain of shiny, curled scrap which offers one of the best object lessons of progress in the field of salvage.

This stuff comes from the can factories and other tin plants. It represents waste in the manufacture of everything from the lightest kitchen ware to the heaviest galvanized utensils. For years tons of it were thrown away. Because of its extreme light weight the scrap curls in all directions, with the result that it takes up a great deal of space. It was so bulky and so difficult to handle that it was not worth while for industry to attempt to save it. Even when the demand for finished products ran far ahead of the supply of raw material from the original sources — the mines — manufacturers could not find a method of utilizing this scrap. Its bulk may be indicated by the fact that ten tons will fill an ordinary coal car.

A few years ago this junk concern made inquiries and learned that there were many tin plants which would be glad to use this material if it could be reduced in bulk. The firm promptly installed a hydraulic press. Its chamber is twenty inches wide, four feet deep and six feet long. It is set

(*Continued on page 33*)

**Steel "skulls" from the rolling mill furnaces awaiting treatment at the junk yard**

## Making Satisfactory Glass from American Clays

By S. R. Winters

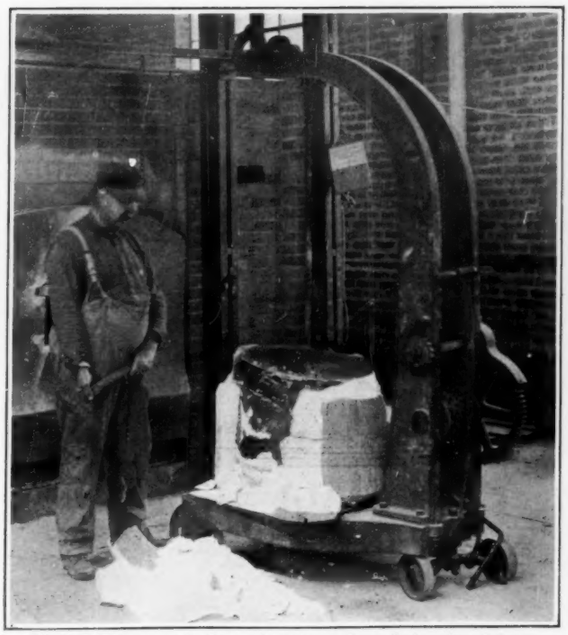
A SERIES of investigations, embracing a three-year period, as conducted by the Clay Products Section of the National Bureau of Standards, has established the merits of domestic clays for the manufacture of glass. Hitherto America has relied upon Grossalmerode, Germany, as an exclusive source for glass refractories, little knowing that portions of Tennessee, Kentucky, Arkansas, Ohio, and Illinois, are veritable mines of clay products.

Plasticity, bending power, and strength are the desired properties figuring in the selection of clays for the glass industry. The fire shrinkage of the American bond clays as contrasted with the imported product is a disparagement in favor of the latter. The extreme furnace shrinkage, however, according to Government scientists, can be overcome by the incorporation of a sprinkling of siliceous clay or sand, by increasing the content of grog or by sizing, and by the use of higher pot-arch furnaces. Siliceous clays, perhaps the most feasible remedy, are plentiful in New Jersey, and sandwiched among the fire-clay deposits of Missouri, Kentucky, Tennessee, Ohio, and Pennsylvania.

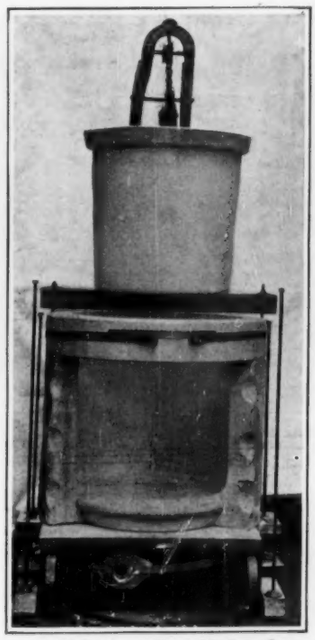
That the porosity of the pot body be as low as possible when the glass charge is introduced, is a prerequisite in glass making. Seemingly, this is contradictory to the requirement that the fire shrinkage be low; whereupon, the Bureau of Standards suggests a compromise by using with the siliceous clay a material burning dense at the furnace temperature. German clay has a porosity of 16.9 per cent at 1,290 degrees Centigrade whereas a Missouri product shows only 8.96 per cent. A happy medium is possible. The Arkansas clay, having a porosity of 25.6 per cent at the above-mentioned temperature, requires a larger volume of dense-burning clay to attain the prescribed degree of compactness. Extreme caution in drying glass pots and tank blocks is essential; otherwise, irregularities will be evident when the pot has been placed in the melting furnace.

American clays resist the corrosion of glass more satisfactorily than the imported product. By way of disparagement, while the German clay is resistant to corrosion sufficiently to meet the requirements for glasses of the soda-lime type, it does not compare favorably in contact with flint glass. The rigidity of siliceous clay at furnace temperatures—its capacity for resisting pressure without deformation—is another feather in its cap. On the other hand, it has a tendency of being fragile when being manipulated in the furnace; a weakness which expresses itself by an inclination to spall under sudden temperature changes.

Looking to the development of American bond clays, a ceramic chemist of the Bureau of Standards recommends the abandonment of the pot-arch construction in vogue and substituting therefor either the down-draft or the up-draft firing common to clay industries. Preferably, the firing should be done from two sides, over bag walls, copying the arrangement of the rectangular down-draft kiln employed in brick burning. A perforated kiln bottom permits the guidance of heat and flames at will, a condition insuring the burning of the bottom of the pots which are placed on blocks. Either the down-draft or up-draft firing, provided ample space is available, renders it feasible to preheat the pots to a higher temperature; possibly, 1,200 to 1,300 degrees Centigrade. Thereby, a maximum degree of fire shrinkage will be accomplished here instead of deferring the process until the material reaches the melting furnace. Such an attainment is desirable.



Block of glass made from American clays, being freed from its coat of slag



Special type of mold for the casting of glass pots

## A Radio Link in Our Telephone System

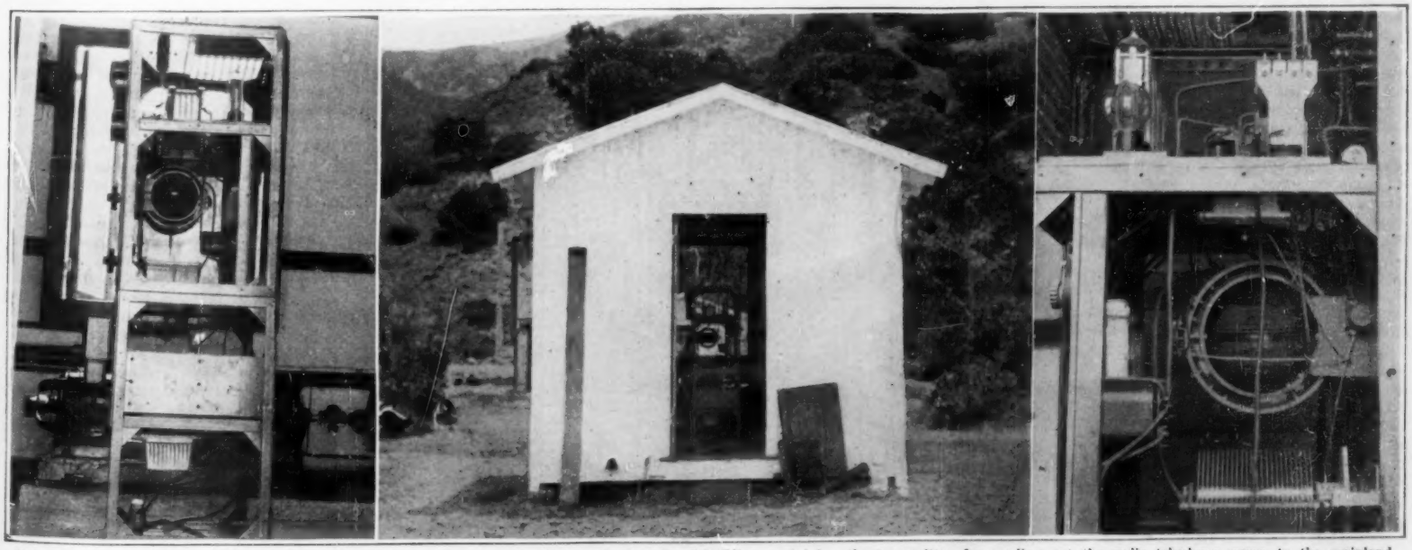
By Frank B. Howe

COMPLETING the latest link in the chain of devices for commercial communication, the first radio telephone to be opened to the public has been established between Catalina Island, California, and the mainland by the Pacific Telephone and Telegraph Company. The system not only establishes telephonic communication between the island and mainland but it can be plugged into the regular telephone service and connected to any subscriber's phone without additions or changes in the regular house instrument. In fact, since the establishment of the service, a heavy concessionaire on the island, William Wrigley, Jr., has been holding daily conversations from his residence in Chicago with his managers on Catalina Island.

The mechanism of the commercial radio telephone is anything but bulky. Walking around the island from the little town of Avalon, one comes eventually into a little cove, free from everything in the way of civilization that would tend to interrupt the waves of the wireless. There are two little white houses, about ten feet square, and two high aerials. That is all. In one of the little sheds is the mechanism for sending messages, or transmitter. In the other is the receiving instrument, which looks much like an ordinary telephone exchange desk. A generator for charging the storage batteries used in the system, completes the list of instruments.

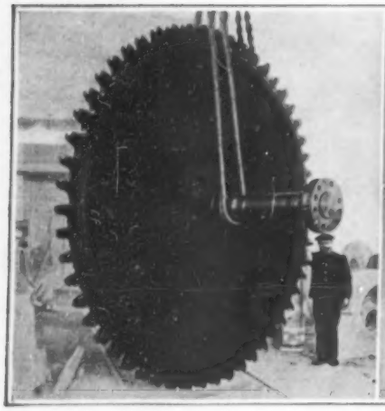
The land end of the system is located at Long Beach, a small city on the southern California coast. Here the connections are made with the regular service, over wires. The charge for a wireless message is no greater than for an ordinary long-distance call—40 cents for three minutes. The distance from Catalina to the mainland is 26 miles.

That the system is successful, there is not the slightest doubt. One can hear as clearly as over the common type of phone and calls are made with equal promptness. One man constitutes the entire working force of the island station. When the writer called the one-man force was out swimming—calls were being made every few minutes, but the mechanism was taking complete care of them all by itself, and there was nothing for the crew to do.

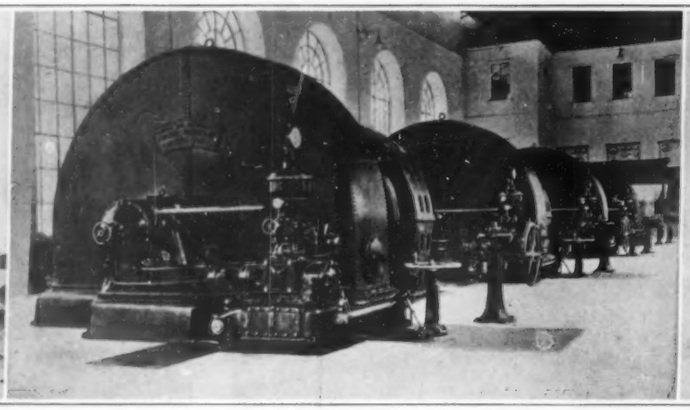


*Left:* General view of the radio telephone transmitter, showing its simplicity. *Center:* Small building containing the transmitter for sending out the radio telephone waves to the mainland. *Right:* Close-up view of some of the transmitter apparatus. Note the oscillation and modulation vacuum tubes in upper left-hand corner, the variometer tuner in the center, and the variable plate condenser below. All the components of the transmitter, excepting such accessories as the motor-generator set, are mounted in the angle-iron frame

**Radio telephone station on Catalina Island, which maintains communication with the California mainland and thence through the usual telephone system**



One of the 12-foot Pelton wheels



Power station, showing the four units each of 3000 horsepower capacity

Method of keying the buckets to the wheel

# Hydraulic Power Under a Mile-High Head

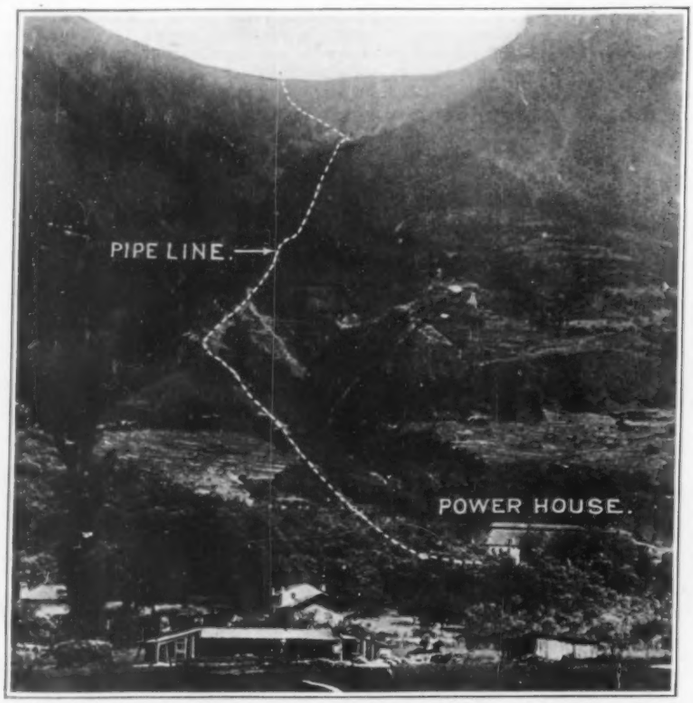
## Some Interesting Details of a Remarkable Pelton-Wheel Installation in Switzerland

AT a distance of a few kilometers from Martigny, in the Rhone Valley, at Fully, Switzerland, will be found a hydroelectric installation which has its own claims to distinction. A power house nestles among the trees of the valley, and above it, 7,000 feet above sea level and between 5,000 and 6,000 feet above the power house, is an Alpine lake, the waters of which, coupled with the difference of over one mile in elevation, furnish the source of power for the generating station. The water is piped from the lake to the power house in a line whose location is indicated by the dotted line in one of our illustrations. The pipeline is 2.85 miles in length and is connected with a tunnel 1,650 yards in length, which is partly under pressure. The net working head is 5,412 feet, which, so far as we know, entitles the Fully plant to first place in respect to operating head among the power plants of the world.

At the generating station, the water is led to four large Pelton wheels 12 feet in diameter, built of forged steel, each of which carries 54 buckets on its periphery. The method of fixing the buckets is that of Messrs. Pickard Pictet, of Geneva, who built the wheels and who are responsible for the hydraulic part of the plant. It will be noticed from one of our illustrations that the buckets, A, are mounted in a mortised groove, R, in the periphery, D, and that they are held by keys, C, which are driven between them. Each of these wheels develops 3,000 horsepower when running at 500 revolutions per minute, and each has a single jet, which strikes the wheel horizontally at its lowest point.

The wheel is fixed on the turbine shaft by means of a cone keyed to the shaft, which is mounted on two self-lubricated bearings carried on a frame that is incorporated with the bed plate. This frame also carries the wheel case, the governor and the jet pipe. Within the castiron bed plate there is formed below the wheel a rectangular funnel, which leads the discharge water from the turbine to a horizontal steel pipe, 4 feet 3 inches in diameter and 33 feet in length. The velocity of the escaping water is nearly 600 feet per second, and at the outlet a baffle plate serves to maintain a certain depth of water which forms a deadening pool to break the velocity of the jet when it is diverted beneath the wheel at the time of sudden removal of the load. The water is led to each turbine by a 10-inch cast steel pipe provided with a manually-operated equilibrium valve. The jet pipe has a nozzle of tempered steel, and the water discharged is regulated by a steel needle which moves in the axis of the jet pipe. A cast steel deflector, placed between the nozzle and the bucket wheel, is raised or lowered by the action of a governor, and when it is lowered it causes a deflection of the jet water from the buckets.

The tests of the installation show that it has a maximum efficiency of 82.3 per cent. It is an interesting fact that the power absorbed by the wheel (whose periphery runs at over 200 miles per hour) to overcome air friction alone was nearly 150 horsepower, or 5 per cent of the normal power. It is noteworthy also that when a load of 3,300 horsepower was suddenly thrown off the turbine, the increase in speed was only 3½ per cent. For the photographs of this plant and the details regarding its construction, we are indebted to *Engineering* and the Hydroelectric Department of Vickers, Limited.




Hydro-electric power house, Fully, Switzerland, which operates under a head of over one mile

### Air Tight Storage and Dry Heat, New Pest Controls

THE ridding of grain of insect pests, through a simple process of hermetical sealing, and the control of seed-borne diseases of various grains through application of dry heat, are two fields of investigation in which agricultural workers have recently made progress.

In England, the Grain Pests Committee of the Royal Society has published experimental evidence of a very favorable nature, drawing the conclusion that air-tight storage is probably the best method of preserving grain and cereal products from insects or mites. The procedure followed in experiments was to take a sample of infested grain, hermetically seal it, and through a variety of tests incorporating different temperatures, different pests, different lengths of treatment, and small and large air-spaces, arrive at a conclusion respecting both the limitations and the possibilities of the method.

Wheat badly infested with mites was freed by sealing for 24 hours at 75 degrees to 80 degrees F. Sealing for 7 days at 84 degrees to 87 degrees F. cleared of infestation flour heavily infested with larvæ of E. kuhniella. Wheat infested with larvæ and eggs of Calandra oryzae was cleared at 75 degrees to 80 degrees F. in 28 days, with larvæ and eggs of C. granaria at the same temperature and period, with larvæ and pupæ of C. oryzae at 88 degrees in 25 days. Air-tight storage of Indian wheat for 23 days at 88 degrees F. cleared the sample of Rhizopertha dominica. This sample was afterward kept in room temperature for nine weeks, but remained insect free.

Still other experiments were made with favorable results. It had been urged against this process that it might be accompanied by the process known as "heating." In order to have a conclusive test on this point, the grain used, sealed in thermos flasks, purposely contained excessive moisture. Not only did no "heating" result, but the method was also found to prevent the growth of molds. Owing to the exaggerated moisture the wheat became acid, but the authorities state there is no reason for thinking this would occur in normally dry grain.

The control of seed-borne diseases in grain is reported on in an official American publication. This is a subject naturally of most interest to farmers and seed dealers. The experiments with dry heat were rendered particularly important because of certain seed-borne diseases which do not yield to the ordinary chemical and hot water treatments.

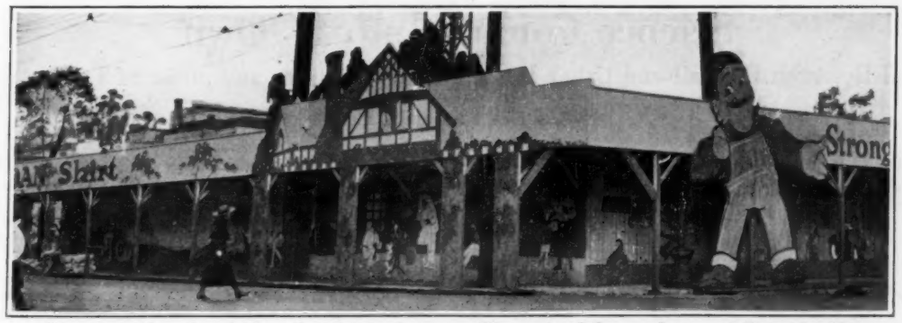
These diseases include bacterial blight of barley, bacterial blight of oats, wheat scab, spot-blotch of barley, net-blotch and stripe disease of barley, and Helminthosporium blotch of oats. It was found that bacterial blight of barley and bacterial blight of oats can both be eliminated by exposing the infected seed to dry heat at temperatures which leave the seed still viable.

A number of seed-borne fungous diseases, including wheat scab, primary infections only, and spot-blotch of barley, are practically eliminated by the dry heat treatment as used. Striped disease of barley, loose smut of barley and smuts of oats, are markedly reduced by dry heat without inflicting material injury to germination.

Experiments appear to indicate that barley, wheat, rye and oats, especially when of good quality and well-dried, are able to withstand long-sustained exposure to dry heat at relatively high temperatures.

### Shutting Out an Eyesore

TO hide the unsightly appearance of a building under construction a Los Angeles architect devised the unique idea of building an ornamental fence around the entire structure that was entirely out of the ordinary. The outline of the fence in places was built to resemble the roofs of California bungalows and the painter completed the bungalow with his brush, working in the windows, pillars, vines and trees and people in the windows. Parts of the fence were also used for advertising, with a lot of clever art work, the whole scheme being to make a beauty spot out of what otherwise would have been a neighborhood eyesore.




The "bungalows" and the advertising sign are alike parts of the wooden camouflage of a big building operation

### The Shock Loader

A MECHANICAL shock loader which can be driven down a row of corn or small grain shocks, pick up the bundles and elevate them into a rack driven alongside, is shown in the accompanying illustration. It is used to a considerable extent in the spring wheat country of the Dakotas and Canada where it saves a great deal of labor in threshing. The principle of the machine is similar to that of the hay loader, except that the bundles or shocks are picked up at the front instead of at the rear.

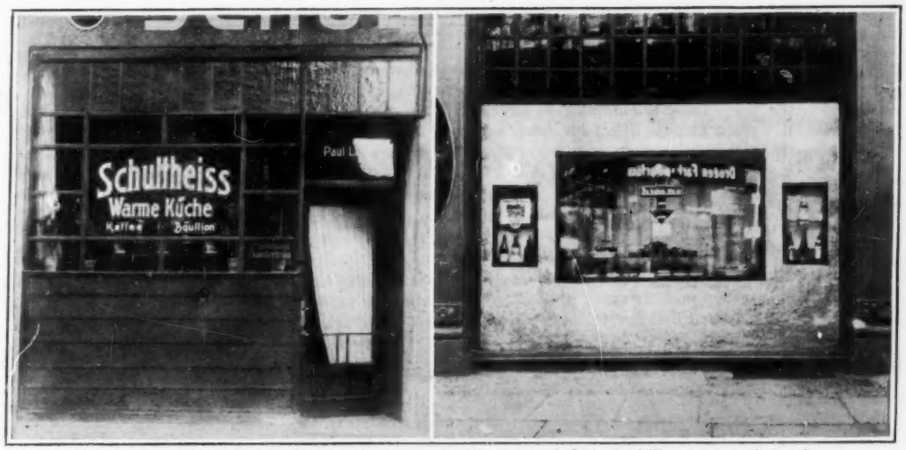
Saving labor at threshing time with the shock loader. Machines of this kind are used to a considerable extent in the spring wheat country of the Dakotas and Canada

### A New Track-Laying Device

OUR cover this week shows a special machine for laying and lifting track, recently perfected. It consists of a structural steel frame for placing on a standard flat or logging car. This frame carries on an upper deck a two-drum engine to operate a load line and a "traffic" line. Two cars hooked up with a locomotive, the machine car ahead and the tie car next to the locomotive, comprise the equipment ready for work. The trolley track is constructed of two channels riveted to form a strong girder with the flanges forming a track for the trolley carriage to traverse. The trolley track is constructed in three sections and is attached under the upper deck so as to provide clear passage for the carriage throughout its length.

The machine is built for lifting a maximum load of 4,000 pounds at either extreme end of the boom and for carrying the load either way the full length of the boom. The normal hoisting speed of the load is 100 feet per minute, and the normal speed of the carriage traversing the boom is about 200 feet per minute. The capacity of the equipment for the load of rails and ties depends upon the carrying capacity of the cars used and upon the railroad track. There is ample space in the machine for carrying 150 sixty-pound rails, still leaving sufficient room to pass a bundle of 15 ties through the machine. In practical use an average load with ordinary equipment is sufficient rails and ties to lay a quarter mile of track.

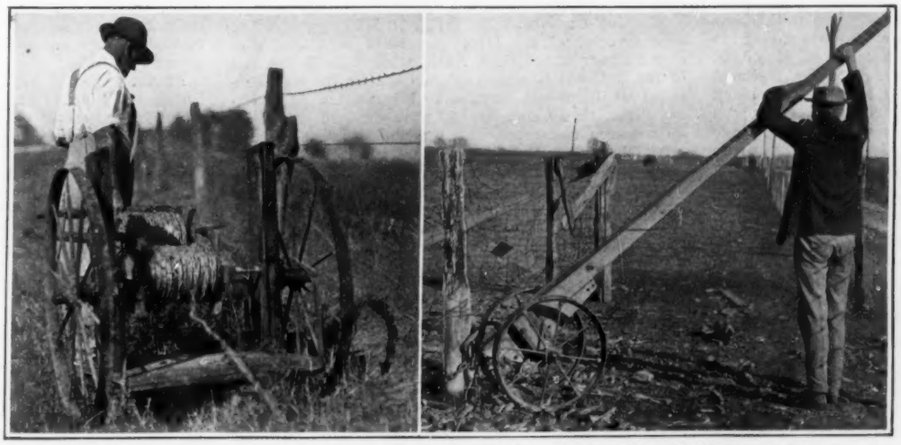
The machine is also used in placing bridge structures. The boom reaches out far enough to place sills, caps or complete bent if the bridge is constructed that way. The timbers or stringers are picked up with the machine from the side of the right of way, carried on the rail car or the tie car to the bridge, and lowered to the exact spot desired.




How two continental shop-keepers have made the most of their inability to get plate glass for their front windows

### "Ersatz" Window Dressing

WINDOW dressing, it might appear, is dependent entirely for its effects upon the presence of a real window, a sheet of plate glass filling the entire space between the door and the corner of the building. In parts of Europe, however, plate glass has been destroyed on a much larger scale than that on which it has been replaced. The ingenious seeker after show effects is then obliged to turn his imagination into new directions, and evolve a display which shall not call for the full window. We illustrate the manner in which two continental shops have solved the problem. One of them has replaced the single sheet of the unobtainable plate glass by a number of panes of ordinary window glass, and has succeeded in designing the frames of the latter in such a way as actually to attract, rather than to offend, the eye. On and behind these panes we see the customary signs and display of wares. Another has taken the bull more boldly by the horns and substituted a large ornamental sign for the window, leaving only a few panes of glass at the top for illumination.



*Left:* A modification of the milk cart in use as a means for unrolling wire from the spool direct to the fence.
*Right:* An effective post-puller

Speeding up the business of fence replacement

### Tools for Fence Makers

TWO handy devices to be used in fence making and tearing down are shown in the accompanying photographs. The one is an attachment to the milk cart for unrolling wire from spools and the other a device for pulling posts. In the former a steel rod is placed through two wooden uprights and supports the wire spool. Any farmer could easily make a cart for this purpose if he did not have one already in use. The post puller is simply a long lever mounted on two wheels near one end with a hook attached which is fastened to a chain wrapped around the base of the posts. The wheels act as the fulcrum of the lever and should be heavy enough to support a rather severe weight, for a tremendous leverage is secured.

# Science Coming Into Its Own

## The National Research Council and Other Research Organizations and Some of Their Achievements

By Charles Frederick Carter

THIRTY million dollars, as nearly as can be ascertained, will be expended in scientific research for the further development of agriculture, engineering and the industrial arts in the United States this year. Of this investment in brains one-third will be contributed by the National and State Governments, the other two-thirds by private enterprise.

While scientific research was begun some years ago no less an authority than Dr. J. R. Angell, who was chairman of the National Research Council and who is now president of Yale University, is responsible for the assertion, made two years ago, that "research in industry is astonishingly backward (in America) as compared with Germany and even with England."

It is one of the ironies of fate that a nation so little inclined to war, so given to industrial self-complacency, as the United States should owe so much to war as a stimulant to the scientific development upon which industrial progress is built. Yet history records that Lincoln requested the creation of the National Academy of Sciences to help solve problems vitally affecting the conduct of the civil war; and that more than half a century later Wilson asked that the organization founded on Lincoln's initiative should be expanded into the National Research Council to assist in mastering the technical difficulties encountered in the conduct of the greatest of all struggles. It is directly due to the efforts of this National Research Council that the activities of scattered research agencies have been coordinated and given fresh impetus pursuant to former Chairman Angell's position that "It is essential that we conceive of research as the organized technique of science itself, working for its own propagation."

Now that this great organization, embracing some forty scientific societies with memberships running into the thousands, is becoming more fully readjusted to peace conditions it promises to exert a more potent influence on industrial progress than it did on the conduct of the war; and that is saying much. Science is, indeed, coming into its own.

The National Research Council may, perhaps, aptly be characterized as the General Staff in command of the Nation's industrial army in its advance into the Unknown. Continuing the military simile there are several hundred divisions, each consisting of a research laboratory maintained by some industrial corporation with a staff ranging from a score to some hundreds of technologists in charge of a director of research and each devoted to the particular lines of investigation and development in which its employer is interested. Strange as it may seem not even the National Research Council has been able to make an accurate and complete census of the research laboratories and forces in America; but it has been able to list approximately three hundred such laboratories.

An indication of the importance attached to this new research organization is to be found in the fact that the Carnegie Foundation has made a grant of $5,000,000 for a building and an endowment for the National Research Council. The permanent home of the council is to be in Washington. Further recognition has been given by the Rockefeller Foundation which has made a grant of $500,000 to be expended within five years to promote fundamental research in physics and chemistry at educational institutions in the United States and to found fifteen or twenty research fellowships.

As a final impressive recognition of the important part science is to play henceforth in shaping the destinies of the Nation the Government designated Dr. C. S. Howe of the Case School of Applied Science as Scientific Attache to the American Embassy at Paris—the first scientific attache, by the way, in the American Diplomatic Service.

The activities of the National Research Council will be as broad as the needs of man. For example, it has under consideration a nation-wide investigation of reforestation, such as no single agency could handle. No comment is needed to demonstrate the urgent call for such an investigation and for the prompt application of all the knowledge that may be acquired; for it is notorious that unless present practises are quickly curbed our forests will be utterly destroyed.

Another wide problem calling for study on a most extensive scale is the adaptation of soil fertilizers to different regions. Because newly cultivated fields in many parts of the country were almost unbelievably fertile farmers have too generally proceeded on the theory that the riches which Nature had been storing in the soil for ages never could be exhausted. Now the truth is all too plainly evident that if the country is to be fed science must be applied to agriculture.

Research in industrial arts is separated into seven divisions representing science and technology. It should be understood that the National Research Council does not itself undertake all the numberless investigations that are needed. Rather it undertakes to coordinate the work of others; to disseminate available information; to act as a sort of clearing house through which investigators widely separated and unknown to each other can be of mutual assistance. It has often happened that men have worked weary months, perhaps with indifferent success, on an investigation that had already been thoroughly carried out by others, because the results of such work were not available in the libraries within their reach. The Division of Research Information, therefore, will by no means be the least important bureau of the National Research Council.

The greater part of scientific research in industrial arts will continue to be carried out by private bureaus. Perhaps the largest, most highly developed and best known of these private research laboratories is that of the General Electric Company at Schenectady, N. Y., occupying a seven-story building with 66,500 square feet of floor space. This building was erected for purposes of research and so is unusual in equipment. Special pipe galleries accommodate pipes for hot and cold water, distilled water and just plain water. There are pipes for compressed air, for vacuum, for wires for various kinds of electric currents. There is a liquid air plant with a capacity of five gallons a day and there are electric furnaces capable of producing extremely high temperatures.

The staff consists of Dr. Willis R. Whitney, who has been director of the laboratory since 1904, and who as a member of the U. S. Naval Consulting Board and of the National Research Council during the war, rendered distinguished services to his country; 2 assistant directors, 50 chemists, 12 physicists, 13 engineers, 50 research assistants, and machinists, glass-blowers, electricians and clerks to the total of 225.

Research here covers a wide range, including electrochemistry, physio-chemistry, metallurgy, electric insulation, electric furnace products, lamps, and alloys, rectifiers, heat insulation, furnace products, wireless telegraphy and many other things. Things that seem queer to the layman are done in this big laboratory. For instance there is a "bug farm" where a cereal beetle which is becoming unpleasantly frequent in flour, oatmeal, and many other food products is bred by thousands for experimental purposes. The investigators were seeking a way to kill the eggs before they could be hatched, with a view to preventing the waste of the flour or other food products. It was found that X-rays were effective.

Many problems in pure science are studied, such, for example, as the structure of the atom. The General Electric Company has no idea what it would do with the information if it had it. Indeed it is no unusual thing for a member of the scientific staff to pursue a line of study for months without any idea of where he is going or what he will do when he gets there. This is in line with the settled policy of the company; for experience has taught that a given investment in brains will yield dividends as surely as an investment in a gilt-edged security. It is accepted as an axiom at Schenectady that there is no scientific investigation, however remote from industry, which may not possibly lead to industrially useful developments.

"It is rare," says Dr. Steinmetz, "that sooner or later some industrially valuable results do not follow, no matter how abstruse or remote from apparent utility a scientific investigation may appear."

For example, no immediate or direct benefit to the General Electric Company could be foreseen when the consulting engineering laboratory undertook an elaborate research on the electrostatic corona and dielectric phenomena in general. The investigation was assumed to be justified on the ground that greater knowledge of these phenomena might extend the economic limits of long distance power transmission and thus increase the market for transmission appliances. But before the research was completed it led to the redesign of practically all high voltage transmission apparatus and thus amply justified the undertaking.

The Westinghouse Electric and Manufacturing Company maintains a research staff which ranks among the half dozen foremost. The director, C. E. Skinner, and staff of 132 engineers, chemists, physicists and assistants have five laboratories at their disposal, including a research building, in which investigations are conducted on lamps, incandescent solids, luminous gases, magnetic materials, photomicrography, metallurgy and photometry, conductivity of metals, linear temperature coefficients and electrical insulation.

The laboratories of the Western Electric Company are functionally a part of the engineering activities of the whole Bell Telephone System. They include a physical, a chemical, a transmission and a physical testing laboratory employing a total of 925 chemists, physicists, engineers, designers, draftsmen and assistants. The problems studied in the chemical laboratory relate to magnetic and non-magnetic materials, preservation of timber, very thin-and high-grade papers used in telephone condensers and kindred subjects. The physical laboratory is equipped for fundamental research in all problems relating to telephony, telegraphy and signaling on land or sea.

The E. I. du Pont de Nemours Co. employs a research staff consisting of a director, 400 graduate chemists and engineers, and assistants and workmen to the total number of 1,189 in four laboratories scattered in three states on problems relating to the manufacturing operations of the company, including miscellaneous chemicals, dyes and intermediates, explosives, coated fabrics, plastics, pyroxylin solutions, lacquers, paints and varnish and the production of miscellaneous raw materials, such as mineral acids and nitrates of soda.

Another research staff ranking among the half dozen foremost is that maintained by Wilson & Co., packers of Chicago, consisting of a director and ten assistants studying problems connected with fermentation, spoilage, hydrogenation of oils, refining and handling of oils and by-products. The Eastman Kodak Company has a research staff of a director and 40 chemists, physicists and photographic experts with 30 assistants studying the theory of photography, new photographic materials and theory of manufacturing processes. The National Aniline and Chemical Company maintains a research staff of ten chemists which devotes its entire time to the study of problems relating to dyes and intermediates.

The foregoing will give some idea of the extent to which research is now conducted in the industrial arts and perhaps an inkling of the nature of some of the problems. Altogether there are now about five thousand scientists and assistants employed in research by manufacturing corporations. Their investigations cover practically the whole range of materials used in manufacture and the resultant products. The value of their labors is beyond calculation; the tungsten lamp alone has saved the country $400,000,000.

*EVERYBODY today is impressed in an abstract way with the value to industry of scientific research, and through industry of its value to the nation at large. It is not always so clear that scientific research pays direct dividends to the person who meets the bills; and for this reason there is a fairly definite tendency to leave it to the other fellow. Plenty of big business concerns are in a position, to be sure, where they are obliged to endow extensive research activities; but as many others fail to do this because they are not actually forced into it by circumstances. What is everybody's business used to be nobody's business; today the proverb is altered, and everybody's business becomes the Government's business. In this article Mr. Carter tells us about one of the most effective agencies of Governmental supervision of scientific research that has yet been devised.*—THE EDITOR.

# Weapons at Sea

## The Place of Aircraft and the Battleship

By Commander E. G. Allen, U. S. N.

A WEAPON in war, theoretically, depends for value upon its armament, protection and mobility; and, for practicability, given an employment of it, upon its destructive power, the ease and economy of its employment, and the relative protective measure afforded while using it, compared to the relative protection which can be used to frustrate it or stand up under its blows.

In new departures in warfare, and with new weapons, the offense is normally developed, initially, at a rapid rate compared to counter-protective measures. In wartime this is largely due to secrecy and the tremendous energy put into the design, production and employment of the new weapons; while in peace time, inertia, conservatism, and lack of vision with respect to new developments, produce the same effect. *Disaster in sight* is what quickens the vision and produces the energy to enable defense to obtain rapid development. So, it usually occurs that, given disaster ahead, defense is accelerated and eventually catches up. Its rate of overhead depends, in peace time, upon the vision, energy, and persistence of the responsible officials, and, in wartime, upon the urgency of the necessity—at home, upon the inventiveness, money, and available production facilities, and, in the field, upon strategical dispositions and the tactical ingenuity of leaders.

This is applicable ashore and afloat and has been the history of development in all warfare. We may assume that with the first development of the stone axe and the bow-and-arrow by prehistoric man, rough helmets and shields appeared almost simultaneously; and, in later periods as lance, sword, and cross-bow came into existence, chain armor and similar defense paralleled the offense.

In the late war, such developments as the submarine, tank, gas, and machine gun, and massed artillery with explosive shell and gas, caught the defense lagging materially and tactically. Aircraft came as a distinct innovation and the defense is still not perfected materially or tactically ashore or afloat. Aircraft, if counter air defense is neglected, has under the theoretical value of a weapon, namely *armament*, *protection* and *mobility*, tremendous values. As *armament* it can carry gun, bomb, or torpedo; while *protection* is assured by operating at will in a medium heretofore not used by man in war, and its *mobility* is the greatest yet achieved by man in a weapon.

This feature, the retardation of defense development in peace, was illustrated by the status of the submarine in the late war. Great Britain, with a huge sea commerce, her home government centered in a small island, located near probable enemies, and dependent for existence on sea-borne commerce, had lacked ordinary foresight and vision in perfecting her submarine defense. Similarly, the underwater protection of her capital ships had lagged behind torpedo development. Necessity in war compelled her to perfect this anti-submarine defense in two years.

The initial destruction wrought by the submarines, tremendous in its effect, brought the usual storm of fanaticism relative to the value of the submarine as a weapon. In this country a serious move arose to intrust the entire national defense at sea to the under-seas boat. The submarine has now, in a large measure, found its place; its proper value and its limitations are recognized. Defense against it is to a great extent perfected materially and tactically. It is almost beyond a possibility that in a future war the defense could lag to such an extent that the submarine should be the determining factor of the war.

The advantage gained by the submarine is not in a new armament, but in the relative protection it secures from invisibility in approach, attack, and getaway. Absolute cover from vision is its prime asset.

Aircraft has not this advantage, its primary asset being mobility, rendering surprise easy. Aircraft will employ no new armament, and the defense is given the same old problems, namely, to combat bombs, torpedoes and gas fire, when used with great mobility in war. The defense at sea against aircraft is an easier problem than submarine defense, because aircraft is not invisible. It is both visible and audible, and defensive measures can be positive in that the attack is located and fixed by vision and sound.

By water-tight subdivision and armor, the capital ship already has in a large measure protection against the weapons enumerated, namely, bomb and torpedo, and can be made immune by simple arrangements against gas. With the addition of more horizontal or deck armor, the aircraft bomb can be discounted as a serious weapon against such armored ships. Against merchant vessels, destroyers, light cruisers, or plane carriers, the aircraft bomb has a case.

Counter-air-defense is, logically, the major counter against air attacks, and anti-aircraft gun defense is the secondary counter. Afloat, anti-aircraft guns should be of more value than ashore for the following reasons: *Afloat*, the battery is always at the scene of the object to be protected; *ashore*, the anti-aircraft defense is usually spread out to cover a line. Once over this line, the bomber drops his bombs at leisure unless the object to be bombed has additional local defense.

At sea, there is, over each particular ship, a limited vertical rectangular area bounded by the height and speed of the bombing aircraft in which such aircraft must be to hit the ship. If not in this area, when dropped, the bomb misses. Counter air fixed-barrage can be adjusted to keep high-explosive shell bursting in this area, rendering bombing unsafe and difficult. This secondary defense must, of course, be supplemented by a major one employing protective pursuit planes. These combined defenses, properly organized, should render a fleet practically immune from bombing.

The torpedo plane, however, is a more serious weapon than the bomber, due to its greater flexibility for tactical purposes—torpedoes can be released at various ranges and on any bearing—and due to the fact that

(*Continued on page 33*)

# A Chat with Madame Curie

## What the Discoverer of Radium Thinks of Us and What We Think of Her

By Austin C. Lescarboura

THAT virtually impenetrable barrier placed about Madame Curie since the very day of her arrival in New York City and resolutely maintained against repeated but futile onslaughts of press photographer, newspaper reporter, special writer and technical journalist alike, was removed for a few hours on the eve of her departure for France. All our previous efforts to reach the discoverer of radium were absolutely wasted. But on June 24th, the day prior to her sailing on the "Olympic" with her precious gram of radium, Madame Curie granted us an interview at the home of her hostess, Mrs. Meloney, in New York City.

First of all, let us hasten to assure the gentle reader that Madame Marie Sklodowska Curie is not one who would set herself apart from the public. This matter of refusing to grant interviews and pose for almost countless press photographers was not one of her own choosing. It was an imperative measure arising out of her poor state of health. And when it is borne in mind that the workings of the modern press and news picture machinery are such as even to wear out robust persons, we can readily see the justice of the barrier thrown about Madame Curie.

She carries honor and fame gracefully, this wonderful woman. For despite the fact that Madame Curie had fifty-five degrees from numerous universities, colleges, laboratories and other institutions before coming to this country, to which must be added ten more degrees conferred upon her by American universities and colleges during her seven-week sojourn in these United States, Madame Curie remains—and always will remain—just plain Madame Curie.

Unassuming, plainly but neatly dressed, womanly and motherly in appearance, yet keen when the conversation swings to scientific matters, speaking a delightful English that is flavored by what may be a trace of her Polish birth and a good bit of French, her adopted mother tongue—that, in brief, covers the outstanding features of Mme. Curie as we saw her, questioned her, listened to her for upward of an hour.

Before going ahead with Madame's little talk with us, it may be well to run over the major details of her all-too-brief stay in America. Madame Curie came here from France on May 11th last in order to receive a gram of radium—the gift of the American women in recognition of her services to science and humanity. The gram of radium was presented to her by President Harding on May 20, 1921, at the White House. Between May 11th and June 25th, the day of her departure, Madame Curie visited most of our leading universities, colleges, laboratories, Government bureaus, cities and natural wonders.

As already stated, ten degrees were conferred upon her in recognition of her contributions to science and humanity. Smith College conferred the degree of Doctor of Science; Doctor of Medicine was conferred by the Woman's Medical College; the University of Pittsburgh conferred two degrees, Doctor of Science and Doctor of Laws; Yale, Columbia, Chicago, Northwestern, and Wellesley conferred Doctor of Science; and Doctor of Philosophy came from the University of Pennsylvania.

Aside from honorary degrees Madame Curie received numerous other distinctions. Thus the Philosophical Society awarded her a gold medal, which carries a money award of $800. The Naples Table Award of $2,000 also went to Madame Curie, as well as the Willard Gibbs Medal for scientific achievement, which, it is said, has never been awarded to any other woman. This famous scientist was also made Fellow of various technical societies. But despite it all, she remains just plain Madame Curie, working for the good of humanity and for the expansion of scientific knowledge.

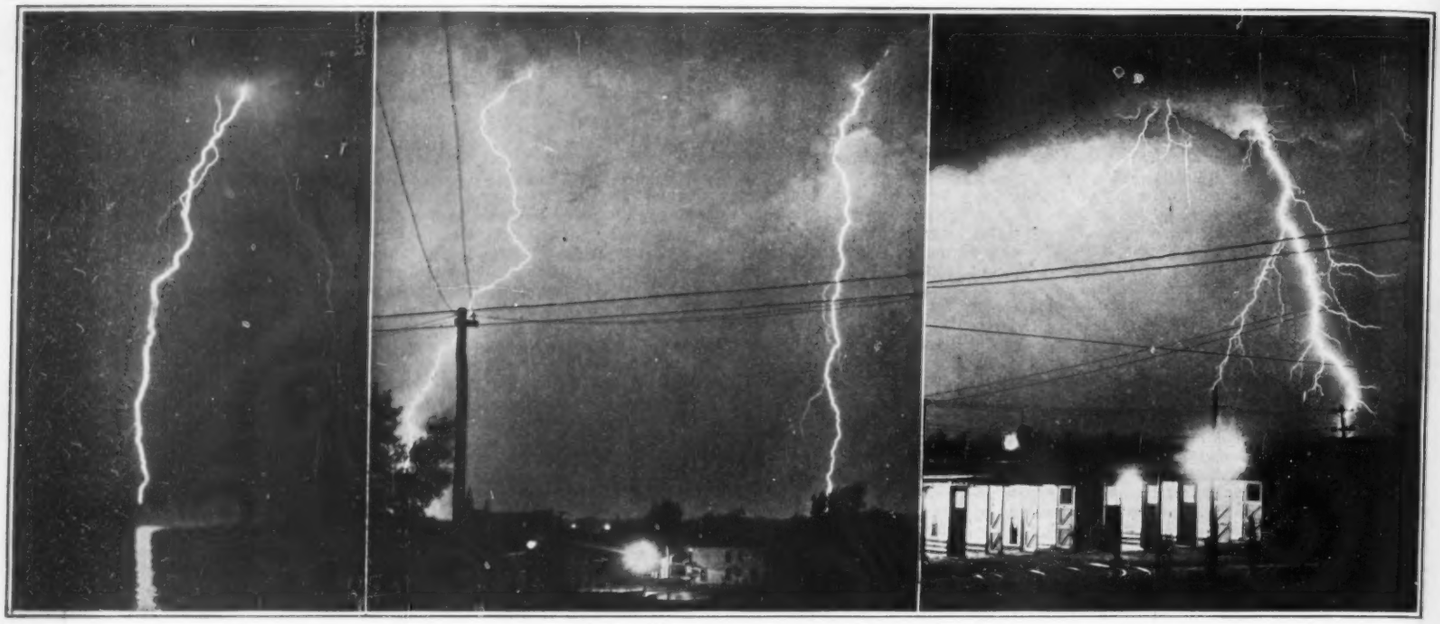
Madame Curie likes America—who wouldn't? She was highly impressed by what she saw and heard at the various American universities and colleges which she visited. While not willing to commit herself to a definite statement regarding the relative merits of European and American institutions of learning, Madame Curie believes that we have excellent facilities for training our youth for every line of endeavor. The girl colleges pleased her immensely, and she commented most favorably on the fact that many of our girl colleges—Bryn Mawr, Vassar, Wellesley, for instance—are located in the country, which is more conducive to good health and quiet study. But greatest of all, in Madame Curie's opinion, are our free institutions of learning, especially in such centers as New York City, where the lack of financial means need not necessarily stand in the way of the ambitious boy or girl desiring an academic training.

Both from within and without, we Americans have got into the habit of believing that little we do is done for anything else than to make money. But our dollar-chasing habits have been grossly exaggerated, so it seems. For we asked Madame Curie if she found our scientific laboratories interesting, and she replied that she did. Following that, we asked, in a somewhat abashed way, if she thought we were contributing anything to science, instead of taking science and molding it into the ways of industry for the pure and sole purpose of making money.

Here is the answer: startling, to be sure, but nevertheless true. Madame Curie believes that much of the work done in our leading laboratories and universities is done for the sake of science—pure science—and does not contain the slightest trace of industrial motives. Our Government laboratories are doing wonderful work in many different directions for the good of science and humanity at large, and with the dollar sign conspicuous by its very absence. Truly, we are not the money grabbers or dollar chasers that we have been made out to be by others as well as in our own minds.

Still, there is something wonderful about our industrial prowess. Madame Curie was delighted with our development of the radium industry; indeed, we have

(*Continued on page 35*)



Three interesting lightning effects, as recorded by the "still" camera specially adapted for this sort of photography

# Lightning

## A Brief Statement of Its Nature, with Some Figures and Some Photographs

By Jerome Lachenbruch

OF all natural phenomena lightning is one of the least understood. In school many of us were taught to believe that lightning is caused by one cloud striking against another. In other words, the suggestion that lightning is a form of frictional electricity was firmly implanted. This is a far-fetched truth. The element of truth resides in the fact that lightning is the result of an accumulation of static electricity suddenly discharging, and frictional electricity is also a form of static electricity. An explanation of the various phenomena that result in lightning takes us back to a simple discussion of static electricity at rest in contradistinction from electricity in motion.

Every substance is composed of electric charges, both positive and negative. These tend to neutralize each other. But if a substance were to receive positive electric charges from another body, the first would change its polarity and become a positively charged body. This change in polarity occurs whether the charge received be positive or negative. Such additional charge may be given off to another substance or to the earth itself. The earth is known as a neutral body, a sort of reservoir for all electric charges. It receives and gives off both positive and negative charges according to the needs of substances on or near its surface to attain an electrically neutral state. And it is the tendency of all substances to achieve this neutral condition.

Another phenomenon that must be borne in mind is the fact all electric charges tend to seek the surface of a substance. For example, if you charge the inside of an iron ball you will find that the outside surface is also charged. Carrying the idea into the realm of the clouds we find that clouds, being composed of raindrops, are charged electrically. Each raindrop contains its own charges, and when trillions of them coalesce to form a cloud the total number of charges on the individual drops remains the same, but they are compressed into a comparatively small area. Consequently, the potential of the cloud as a unit rises and a powerful charge becomes concentrated. Now, when this cloud sails over the earth's surface, it discharges its electric load into the earth with a brilliant flash. That is lightning. The flash breaks through the air, pushing the particles of matter out of the way with tremendous force, and after it has passed the air closes about the path made by the electric current. This pushing away of minute substances and the closing in behind the flash causes the roaring sound of thunder.

Lightning occurs not only between various objects on the earth, such as trees and a cloud, but also between two clouds of different potential. Discharges occur, too, from a lower to a higher stratum; and often rain will discharge a cloud silently; in such cases the lightning ceases with the rain. In all cases, however, thick, dense clouds serve as conductors of electricity. And as we know that dry air is a poor electrical conductor a discharge cannot take place unless there is a ladder of moist air between the earth and a charged cloud or between two clouds.

From the layman's point of view, there are two main kinds of lightning, forked lightning and sheet lightning. Forked or chain lightning may be a mile or more in length and usually descends in a zig-zag course. Sheet lightning is but the reflection on the sky of distant electrical discharges.

Sir Oliver Lodge distinguished lightning into two distinct types which he named the A and the B flashes. The A flash occurs, according to Sir Oliver Lodge, when an electrically charged cloud approaches the earth without an intermediate cloud intervening. In this condition, the discharge takes place directly between the cloud and the earth. The B flash, however, occurs when another cloud intervenes between the cloud carrying the primary charge and the earth. The two clouds then form a condenser; and the discharge from the first takes place into the second. Now the free charge on the earth side of the lower cloud is suddenly relieved, and a discharge from the latter to the earth follows. But it takes such an erratic course that no known lightning conductors are an adequate protection against it.

The accompanying photographs and others of the same sort are the result of a technique developed at the Dominion Astronomical Observatory in Ottawa, Canada, and applied chiefly by the U. S. Weather Bureau and the Mt. Wilson Observatory, as well as by the Canadian meteorologists. With them as a background the story of lightning has been animated so that the actual flashing of the various kinds of lightning may be seen on the motion picture screen. An interesting phenomenon, not visible to the naked eye, sometimes occurs in such photographs in the registration on the sensitive photographic plate of black streaks known as the Clayden effect. This has rarely been successfully photographed.

If the meteorologist is interested primarily in the cause of lightning another type of scientist will deny contentment until he knows the various quantitative data with reference to the flash. Dr. Steinmetz, in a recent interview, supplies some of these. He estimates the difference in potential between the cloud and the ground, or between the two points of discharge in the clouds, to be no less than 50,000,000 volts. The current in the flash he states as 10,000 amperes. Both these values, of course, are averages and may be materially exceeded by individual flashes, which may likewise fall far short of the figures stated. But in spite of this tremendous voltage and amperage the actual power value of the flash is comparatively small because of the extremely short duration. Dr. Steinmetz estimates this factor at 50,000 kilowatt-seconds, or less than 2 of the kilowatt-hours that we find charged for at current rates on our lighting bills at the end of the month. So if we could catch all the current of an electric flash and put it to work under conditions the most favorable to its usage, it would be worth only sixty or seventy cents. Mr. Steinmetz points out that our impression of the duration of the flash is not at all to be relied on. If it is bright enough to be seen at all, it must of necessity, by the principle of visual persistence familiar to all movie fans, look to us just as it would look if it lasted one-tenth of a second. Indeed, when it is of extreme brilliancy, the effect of dazzlement is added to that of ordinary visual persistence and we are convinced that the flash lasted for several seconds. This is seldom, if ever, in accordance with the facts; Dr. Steinmetz sets .0001 second as the duration of the flash, and any student of electricity will realize that this must be substantially correct. Flashes of much longer duration must ordinarily be of low potential, though of course there is no absolute limitation to the duration of high-pressure lighning.

### Sewage Disposal in the Country

A SYSTEM by which an isolated dwelling (or small group of buildings) having running water may dispose of sewage safely and at small cost is recommended by the U. S. Public Health Service.

The chief feature of the system, which has been in successful operation in New Hampshire for summer cottages and hotels for ten years, is a rectangular septic tank, of concrete, with a minimum capacity of 94 feet. This will serve 20 people; four cubic feet additional should be provided for each additional person.

The tank should be buried under 12 to 18 inches of earth, as near as practicable to the house, with which it should be connected with piping. The effluent from this tank, which contains organic matter that might be objectionable and even dangerous, is commonly best disposed of by some sort of subsurface irrigation whose exact form will necessarily be governed by the nature of the soil. Full details are given in the report.

Before installing such a system, however, the State health authorities should be consulted, especially in the limestone sections of the country, where care is necessary to prevent the contamination of springs.

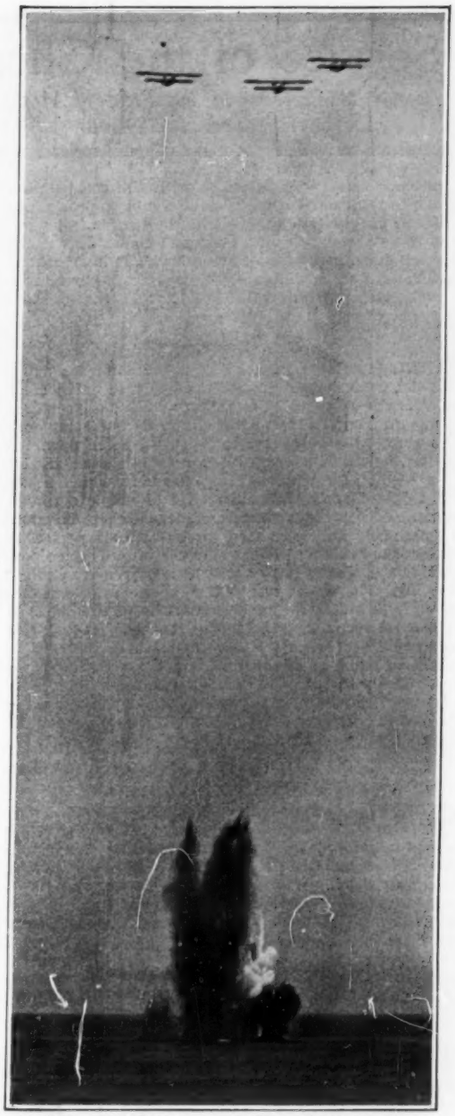
## Bombing a U-Boat

WE referred in our last issue to the fact that the first attempt to sink the ex-German U-boat "117" by aerial bombing was successful, and this week we present a photograph which is unique for the fact that both bomber and bombed appear in the same picture. This was rendered possible by the comparatively low altitude at which the bombs were released, together with the considerable stretch of water which separated the photographer from the target, and probably by the use of a telephoto lens.

The sinking of this U-boat, which, by the way, was one of the later German submarines, was done in sixteen minutes, and the craft now lies on the bottom at a point sixty miles off Hampton Roads. One flight of three "F-5-L" planes sunk the submarine, using twelve bombs in the course of two attacks. The first attack took place at 10:23 A. M., when three ranging bombs were dropped, none of which made a direct hit but all of which registered close to the mark. After passing over the target the three planes returned for a second attack, when nine bombs were dropped from an altitude of approximately 1,200 feet. One of the nine made a direct hit just aft of the conning tower, and the eight other bombs dropped within a very few yards of the vessel.

The first attack with three bombs was made at 10:23 A. M. The second attack was timed at 10:32 A. M., and at 10:38 A. M., the bow of the submarine submerged, the boat sinking steadily until shortly thereafter the conning tower went under and the boat disappeared altogether at 10:39 A. M.

The experiment proves that a single 163-pound bomb if it makes a fair hit on the deck of a submarine will sink her. The fact that only one out of nine bombs scored a hit at the comparatively low altitude of 1,200 feet suggests that if bombing attacks from the air are to be successful they must be carried out at moderate elevation, certainly not above 4,000 or 5,000 feet. The airmen, of course, in the present case had everything in their favor. There was a calm sea, little if any wind, and there was no defense by the customary anti-aircraft guns. Against the much larger target presented by a battleship or a cruiser more hits would doubtless have been recorded than one out of twelve. On the other hand, it is probable that several of the bombs which failed to hit the target, detonated in the water so close to the U-boat that the concussion would have opened her seams and sent her, if more slowly, to the bottom.



**At the top of this view are three airplanes whose bombs are seen detonating upon and around U-boat 117 below**

## Re-Introducing the Trackless Trolley in the United States

A DEMONSTRATION of the trackless trolley bus was given recently at the Schenectady plant of the General Electric Company before a large number of prominent street railway officials and engineers.

A double trolley wire necessary for this type of car was strung up over a route of about ½ mile and the visitors spent most of the day riding back and forth in the car, examining the mechanical features and testing the apparatus. The demonstrations were declared in every respect successful.

The tests took place previous to the placing in service of a number of these cars in Richmond, Va., which will be followed by installations in other cities.

The trackless trolley car resembles in general size and appearance the present one-man safety car and seats 30 passengers. The equipment consists of suitable railway motors and a controller arranged for foot operation.

**One-man trackless trolley car constructed for use in Richmond, Va.**

Two overhead trolley wires supply the current which is taken into the car by a sliding type collector, maneuvered by the motorman from his seat. This arrangement allows a leeway of 18 feet, or 9 feet on each side, for passing other vehicles. Furthermore, this allows two cars to operate in opposite directions on the same wire. The collector can be disengaged, swung off to the side, and reconnected to the wire after passing the other car.

When running over the track area of the system, that is in returning to the barn, the trackless car is equipped with an adaptor on the collector for connection with the standard overhead, and a shoe which fits into the trolley track groove and gives the necessary ground connection.

The chief advantage of the trackless over the regular trolley system is the low initial capital investment. To install a single track trolley line on an unpaved street the cost is about $35,000 per mile. On a paved street, where the trolley company is forced to pay for the pavement between the rails and two feet outside, the cost jumps to $75,000 per mile. The overhead for a single trackless trolley costs approximately $4,500 per mile and where a double set of wires is strung the cost will be about $5,500 per mile.

As compared with the motor bus the operating and maintenance cost is much cheaper. From the standpoint of the rider, it is claimed, it provides a service of equal reliability and comfort, and in many cases the operation is faster and smoother, especially where the streets are well paved and maintained. Comparing the operating cost with the motor bus, gas and oil cost on an average of five cents per mile, whereas with the trackless trolley the cost of electricity is but two cents a mile. The maintenance of equipment including tires, averages 9½ cents per mile for the motor bus as compared with four cents for the trackless trolley. Depreciation on the gasoline bus averages 3.4 cents per mile as compared with 1.9 cents for the trackless trolley. The saving in favor of the trackless trolley is therefore 10 cents per bus mile. Figuring that the average bus runs 35,000 miles per year, this means a saving of $3,500. The first cost of a trackless trolley installation is higher than a gasoline bus—due to the overhead construction required. Interest, depreciation and taxes on this investment reduces the annual savings from $3,500 to from $2,700 to $3,000 per bus in service.

Trackless trolley cars have been in successful operation in some European countries for several years. One hundred miles of trackless system are in use in England, and in Italy several companies are operating over 40 miles of route.

Such cars are not new to the United States, but at present none are, so far as can be learned, in use. The general purpose of this car is not to supplant or take the place of the ordinary rail system for the business districts or thickly settled sections of a city, but to make it possible to operate trolley cars in suburban sections where the cost of laying and maintaining rails and ties would make the extension of lines impracticable.

## Barn Screens, Too

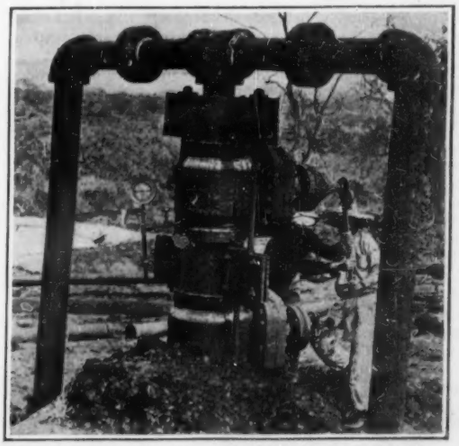
A LARGE dairy farm keeping pure breds and known for its excellent business management screens its barns—windows and doors—in summer just as diligently as ever any dwelling house was screened. An endeavor is made at the same time to keep the barn clean. The twin measures do a good deal to abate the fly nuisance, which at present production costs is a serious one in summer on thousands of dairy farms in this country.

There is absolutely no question of the effect of discomfort on milk production. The cow pestered by flies gives less milk, often markedly less. Dairy farmers now do various things to combat the fly nuisance, but usually a combination of measures is best.

## Capping an Oil Gusher In Minutes to Save Thousands of Gallons of Oil

A GOOD deal has been said in the past about the enormous quantities of oil that are wasted year after year through the inability of oil field workers to control gushers. Following the successful drilling operations a good oil well sends up a heavy stream of oil which is blown high in the air; and quite obviously, some means must be employed to cap such a gusher in order to bring the oil supply under proper control.

The accompanying illustration shows one of the several devices that are now being employed in the leading oil fields for the purpose of capping gushers in a minimum of time. Here we see an American engineer and his Mexican helper completing the task of bringing under control a big gusher in the Panuco River district of Mexico. The gusher was stopped in a few minutes, our informant tells us, and the waste of oil was negligible. The heavy iron pipe frame helps to hold down the capping member. The flow of oil is stopped by clamping a cap on the well pipe, following which heavy valves are put on. The valves then serve to control the flow of oil. One of the biggest gushers in that Mexican field was stopped in seven minutes with this device.



**Stopping the flow of an oil gusher by means of a capping arrangement**

# The Service of the Chemist

*A Department Devoted to Progress in the Field of Applied Chemistry*

Conducted by H. E. HOWE, Chemical Engineer

## Making Phosgene Safe

SEVERAL accounts have appeared in the literature relative to commercial uses of phosgene, numbered as one of the deadly war gases. At one time experiments were conducted, showing that it could be used to free sand from iron, but the method proved too expensive. Phosgene, however, does have important uses in our chemical industries, such as the manufacture of dyestuffs, but on account of its poisonous nature its shipment has been a problem, involving the use of such solvents for the phosgene as gasoline, benzine, etc. These liquids absorb about equal weights of the gas, but no excessive pressures are produced; hence shipments can be made in ordinary containers. When these are opened the volatile solvents and the gas evaporate, or if heated in suitable vessels the phosgene can be liberated in a manner facilitating its use.

## Feeding Experiments

IT seems that the processes which have been developed and described for manufacturing cattle food from sawdust, in which a part of the cellulose is converted into sugars, have been based more upon laboratory experiments and theoretical deductions than actual feeding experiments. The Forest Products Laboratory prepared a sufficient quantity of the food to supply three cows for a sufficient time to indicate the desirability of conducting experiments on a larger scale. The Wisconsin Experiment Station cooperated in this work, and the results were so encouraging that it has been decided to feed a larger number of animals a sufficient length of time to reach definite conclusions. This will necessitate the preparation of a larger quantity of such food than has been available heretofore, and the final outcome will be awaited with unusual interest.

## Manufacture of Carbon Dioxide

COMPARATIVELY little has been published concerning the production of this industrially important gas, associated in the popular mind with the soda fountain, although something over one hundred million pounds of liquid carbon dioxide are produced annually on this continent. Coal or coke is burned under steam boilers, producing simultaneously power required for purification and liquefaction, and flue gases from which the gas is obtained. The temperature of these gases is first reduced in a fuel economizer; then scrubbed to [illegible] them, and then passed to an absorption system in which as much carbon dioxide as possible is combined with an alkaline carbonate. This carbonated lye returns through the heat regenerator before passing to the absorption system to renew the cycle. By such a system all heat is fully utilized. The carbon dioxide thus liberated from the boiling bicarbonate solution is separated from the steam as previously noted, cooled and compressed into cylinders.

## Losses in Gasoline Motors

A. C. FIELDNER and associates of the Bureau of Mines some time ago undertook—in connection with investigations relative to the proposed vehicular tunnel to be driven beneath the Hudson, where the composition of exhaust gases is an important consideration—an investigation of the efficiency of gasoline motors. The work included analyses of the products of combustion with various types of automobiles, including loaded and light trucks at different rates of speed, and the close relation between the per cent of carbon monoxide and miles per gallon that might be expected was found to exist. Slight adjustments of the carburetor had an immediate effect upon the amount of carbon monoxide in the exit gases, and some cars were examined in which the incomplete combustion of the gasoline vapor resulted in a loss above 40 per cent in the possible efficiency of the fuel. It was shown that great care in carburetor adjustments will be repaid in increased mileage, and it was brought out in the discussion that the ideal carburetor would be one which would automatically supply richer mixtures for increased loads or increased grades, and leaner ones for less exacting duty. Research is in progress looking to the development of such a device. With it less than one per cent of carbon monoxide would be found in the gases, thus helping to solve problems of ventilation, although it has been maintained by some that the toxicity of gases from internal combustion engines is not due wholly to carbon monoxide. It is understood that the gases involved would not necessarily interfere with the construction of a safe vehicular tunnel, since it would be possible to pump in air through passages at the bottom, allowing it to pass through perforations and to be drawn out through flues in the top of the tunnel. It is estimated that more than a million cubic feet of air per minute must be circulated, and this constitutes no small item of power expense.

## Glass Containers

THE adaptability of glass as a container for many things now placed in tin is already the subject of considerable research. It is recognized that good materials in glass make a more attractive display and also permit the purchaser to be suited as to apparent quality. A new factor comes to light in the experience of a certain foreign importing company which found forty out of sixty-five gallon cans of maple syrup to be minus the syrup upon receipt. Somewhere en route a small hole had permitted an industrious person to extract the contents. Glass may therefore become popular as a container which will be a preventive against thieving. The writer recalls the experience of a manufacturer of imitation maple syrup who in the old days came to a chemist, complaining that his product was being returned because it became black in the cans in which he shipped it, due no doubt to the action of materials extracted from the corn cobs used. This manufacturer had no objection to selling a substitute for the genuine article, but he did object to the action of tin upon his product and had not thought of using the obvious container—glass.

## Colors for Glazes

SOME interesting experiments were reported last fall by J. D. Whitmer with glazes involving colors to be obtained by the use of nickel oxide. In general these glazes consist of the oxides of barium, potassium, calcium, zinc, nickel, aluminum, and silicon, with which magnesium, tin, or other oxides are used, the proportions of the various constituents being varied, depending upon the colors desired. The shades were reported to vary from blue green to grayish green shades, the grays being obtained from the oxide of nickel in the presence of magnesium oxide.

## Lime—Its Properties and Uses

THE Bureau of Standards has issued a revised edition of its Circular No. 30, which is designed to give general information on the subject of lime, its preparation and uses. Of one hundred and sixty leading industries considerably more than one hundred use lime in some form or other. The circular gives brief descriptions of eighteen important chemical industries where lime is used, indicating where and how they use the material and the quantities required. A list of the tests usually applied to lime is given, including such items as chemical analysis, rate of hydration, plasticity, sand-carrying capacity, fineness, proportion of waste, time of set, and compressive strength.

## Permeability of Rubber to Gases

THIS is the subject of scientific paper No. 387 of the Bureau of Standards in which the results of a series of tests are given, including data on the relative permeability of rubber to some of the common gases. The permeability to water vapor is high, being approximately fifty times the permeability to hydrogen. Taking the relative permeability to hydrogen as unity, the following figures are obtained for other common gases: Nitrogen, 0.16; air, 0.22; argon, 0.26; oxygen, 0.45; helium, 0.65; carbon dioxide, 2.9; ammonia, 8.0; methyl chloride, 18.5; ethyl chloride, 200.

## Quantitative Determination of Vitamine

THE importance of this accessory substance thus far not isolated, but a known necessity to the maintenance and promotion of body growth, makes every piece of research upon the subject of value as possibly giving a clew to the ultimate composition of the material. When we have learned this we may perhaps find a way to isolate it and make it available for addition to substances which are cheaper and as nutritive as others and which differ from them principally in containing fat-soluble vitamine. R. J. Williams, in the *Journal of Biological Chemistry*, describes a method for the quantitative determination of the vitamine which prevents beriberi. A synthetic medium is prepared using cane sugar, ammonium sulfate, monopotassium phosphate, asparagine, calcium chloride, and magnesium sulfate. A sterilized portion of this material is mixed with some fresh, compressed yeast. After incubation for eighteen hours the growth is stopped by formaldehyde, is collected by filtration and, after washing with water and alcohol, dried for two hours at 103° Cent. and weighed. The yield of yeast in the medium containing the material being assayed for its vitamine content above that produced in the control experiment is a measure of the vitamine content of such a substance and is expressed as the number of milligrams computed back to one gram of the original material used.

## Insect Powder

THE insecticide effects of common insect powder are due to a combination of acids and esters which first benumb and then kill insects which come in contact with it. It is not ordinarily harmful to the higher animals; but there have been recorded cases of a somewhat serious nature. Insect powder is derived from the flowers of certain species of pyrethrum and was known to eastern Europe more than one hundred years ago. It has been customary for the commercial product to be more or less adulterated with ground stems of the plant, and in the enforcement of the Insecticide Act the Bureau of Chemistry has found it necessary to evolve physiological, chemical and microscopical methods which are satisfactory for detecting adulteration. The results obtained are not accurate to a high degree, but a formula has been developed by which it is possible to approximate the amount of adulteration.

## Ripe Olives

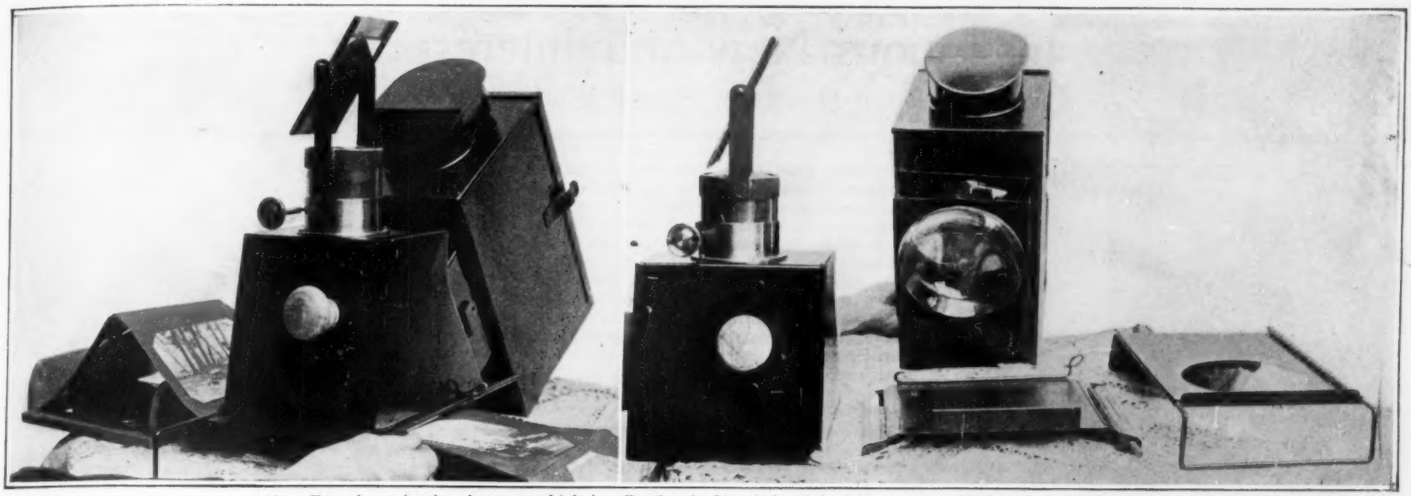
THE Bureau of Chemistry, investigating poisoning due to ripe olives, examined 2,161 commercial containers of which 560 were glass and the remainder tin. Collateral examinations in the case of 1,618 containers checked very closely with odor and appearance in determining the proper condition of the product. The toxic material examined was always sufficiently spoiled to be recognized by an offensive odor at the time the can was opened, and emphasis is therefore placed upon the responsibility of persons who open a sealed container of food and serve it to others before determining its soundness. Spoilage in any form should condemn the product. Bacillus botulinus was found in the material directly concerned in or taken from the pack that caused the poisoning cases during the year, and the serious contamination found was attributed to the practice of prefermenting the product by shipping and holding the olives in weak brine. All of these products were ultimately processed, but carried their contamination over into the canned product, making sterilization difficult.

## Detecting Coal Tar Dyes in Butter

THE method calls first for the separation of the fat from the melted sample by filtration at a temperature not above 100° Cent. About 1 cubic centimeter of the fat in a test tube is heated in an oil bath to 185° Cent., during which time the tube is occasionally removed, shaken, and replaced. Vegetable butter colors, or the natural coloring matter of the butter fades to colorlessness within ten minutes at a temperature of 180 to 190° Cent. This is true only in case the fat has been separated at a temperature not above 100° Cent. If this precaution is not observed it will not become colorless on heating to higher temperatures. Coal tar dyes remain colored at the higher temperatures.

## Inks

CIRCULAR No. 95 of the Bureau of Standards deals with the subject of inks, including methods of manufacture and testing. The information is general and interesting with emphasis placed upon methods of testing used at the Bureau and described in such detail as to make them available to any chemist. Writing and copying inks, duplicating and sympathetic inks, marking, canceling and stamping inks as well as the tablets and powders are discussed. The greatest variety of tests is applied to writing inks where resistance to light and reagents, keeping quality, fluidity, and penetration are determined as well as total solids, ash, iron, sulfuric anhydride, tannin, dye, and chromium content. The circular includes a bibliography.



New French projecting lantern which is effective in broad daylight, shown assembled and taken down

## Counting Bacteria

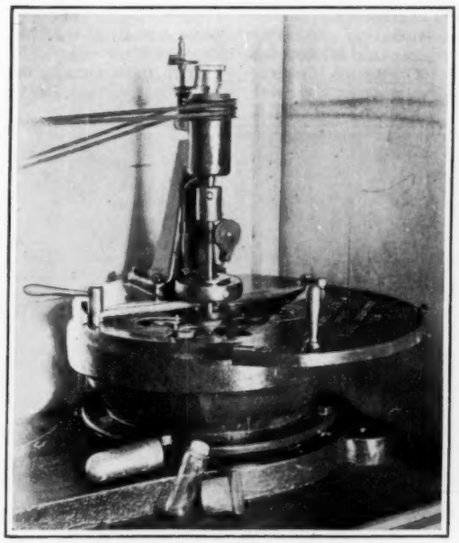
**By J. Boyer**

AT the anti-typhus laboratories of the French Army serums are prepared in accordance with the rigorously scientific though somewhat complicated method of Professor Vincent. These precious immunity-giving liquids do not contain any antiseptic but only billions of typhus bacilli. The emulsion obtained is however too rich in microbes to be used as it stands for vaccination purposes. These cultures are therefore diluted with sterilized water and then very pure ether is added to the emulsion of typhus bacilli. The mixture is stirred for a few seconds and then left alone for five hours after which the lower part which contains all the bacilli and the soluble immunity-giving matter is drawn off. On account of its lightness of weight, the ether floats above the liquid which with the addition of salt water makes up the serum.

But in order to bring the emulsion to the desired density, two billion microbes per cubic centimeter, their number must be estimated, which is done by using the Angus cell well known in laboratories and which enables the operator to count, by means of the microscope, the number of bacteria contained in a very small unit of volume. A certain quantity of pulp is taken together with a determined amount of water, then a drop of the solution is put in the cell which has been previously measured. Knowing this last number as well as the number of microbes contained in said cell, the number of microbes contained in the first emulsion is deduced.

This matter of counting bacteria is a slow one and for some time the French anti-typhus laboratory has been using the opacimeter which was invented by Messrs. Lambert, Vlès and Watteville. This instrument, which completes the work more quickly and precisely, is composed of a photometer formed by luminous circuits in juxtaposition furnished by the same source, one going through the bottle containing the emulsion and the other submitted to a dimming process capable of modifying its intensity in accordance with a determined

(*Continued on page 35*)



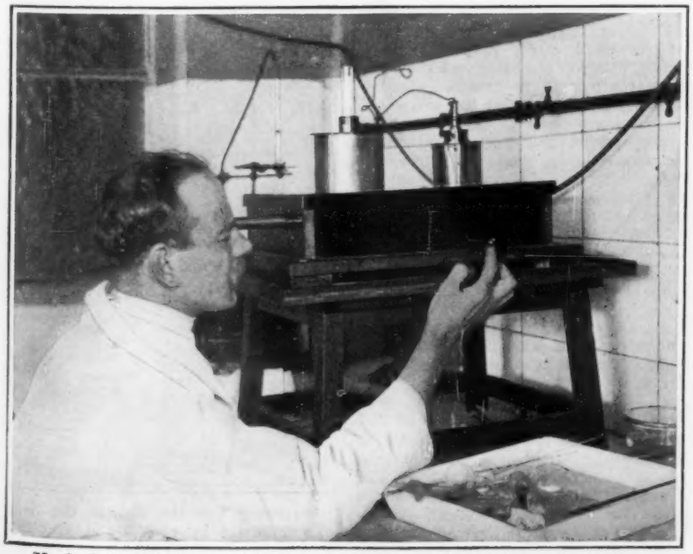
The centrifuge in which the bacterial solutions are given their final preparation for use

## Daylight Projection of Opaque Subjects

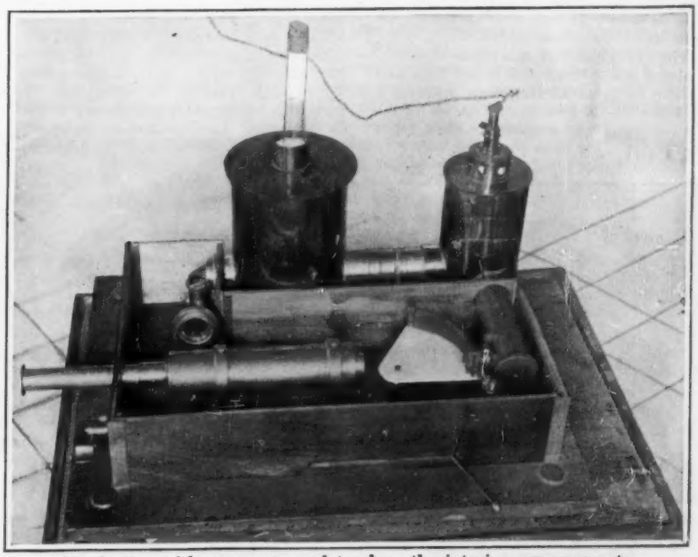
**By George Gaulois**

WE illustrate herewith a recently marketed French apparatus which makes it possible, in a light room, to project either upon a screen or upon any vertical, horizontal or oblique surfaces, with the same degree of freedom ordinarily enjoyed in a darkened chamber. The apparatus is suited for use with lamps and current of any description whatever. The installation shown in our pictures will project upon nine square meters of surface (a square approximately 3 yards on a side). The projection is effected by means of light reflected from the object, rather than by transmitted light; hence no specially prepared negative or transparency has to be made, the projection being direct from the original to the screen. It is anticipated that the new apparatus will have a wide range of utility in connection with the examination in detail of maps, illustrations, etc. The French announcements feature the possibilities of using it in connection with photographic maps made in airplanes, to detect forgeries in documents of any character, to throw upon the screen before an audience original documents of any sort whatever, etc. The secret of the success of the new apparatus is stated to lie in the arrangement of the reflectors behind the source of light, and in the short focus of the lenses employed to concentrate further this light upon the object.

The new French projector is simple enough, as will be noted by studying the accompanying illustrations. It consists of a lamp house provided with a powerful condenser, the balance of the optical system contained in another unit, and the member that holds the subject to be projected in position. By having the objective lens mounted vertically instead of horizontally, the construction is greatly simplified.



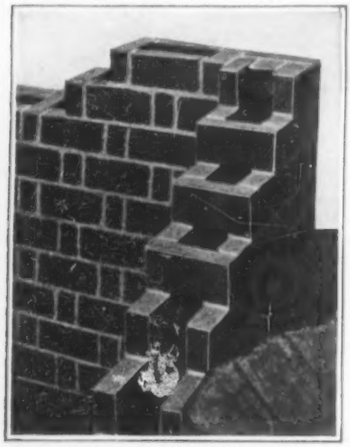
Manipulating the lever of the opacimeter to get the photometric reading



Opacimeter with cover removed to show the interior arrangements

# Inventions New and Interesting

*A Department Devoted to Pioneer Work in the Arts*



**Air-chambers 3½ by 8 inches are provided in this brick wall to absorb moisture penetrating outer wall**

## Something New in Brick Walls, Using Standard Bricks

SOME twoscore building commissioners from leading cities of the country saw an interesting test of the new hollow brick wall, which is being promoted by the Common Brick Manufacturers Association of America, at their recent conference in Cleveland. Practically all of them will recommend it for adoption under the building codes of their cities.

The wall can be built in any thickness and claim is made for it that by reason of breaking the continuous mortar joints that exist in solid brick walls it becomes impervious to the penetration of moisture. Plastering is done directly upon the inside veneer with complete freedom from detrimental moist effects whether the wall be 8, 12 or 16 inches.

In this wall the bricks are laid on edge, with headers at every joint in an 8-inch wall, but at varying distances in the thicker walls. Builders say it offers a saving of one-third in brick, one-half in mortar and twenty-five per cent in labor cost, in addition to saving the cost of furring for plastering when the wall is done. It has been used successfully in half a dozen states.

The Cleveland test was made with two walls of 8-inch thickness, 9 feet high and 12 feet long, paralleling each other at a distance of 12 feet apart. A short return was built at each end. Four types of construction were provided.

Upon a heavy platform upon these walls was built a 12-inch all-rolok wall 4 feet high, forming a complete inclosure. Into this was dumped sand which together with the platform and walls represented an aggregate weight of in excess of 83 tons, the equivalent of the weight of an average two-story, seven-room house, or approximately three times the burden that would ordinarily be imposed upon them. Not the slightest evidence of stress appeared even under this most severe test.

The wall has never been adequately tested but such tests will be made shortly with the ten million ton machine of the Bureau of Standards at Pittsburgh. The Bureau at present is conducting fire tests.

## More Miles to the Gallon of Gasoline

THE little economizer shown in the accompanying illustration fits between the carburetor and the manifold, and enters into the intake manifold. It is made up of a fine mesh of copper wire stretched tightly over a flat spiral, the edges of the wire extending out between two flat plates of asbestos material which is fireproof.

**Simple device which is placed between carbureter and manifold in order more fully to vaporize the fuel**

The gas must pass over the spiral of the economizer and through the fine mesh copper wire, which acts as a sieve. This is said to create a high explosive vapor which reaches the cylinder blocks and explodes with greatly added power. By passing through the spiral and the sieve-like copper wire every drop of fuel is converted into power—an explosive gas and not part liquid such as enters the motor often when no device of this general character is used. It is claimed that 25 per cent gas consumption can be saved.

## A Handy Headlight Control for the Considerate Driver

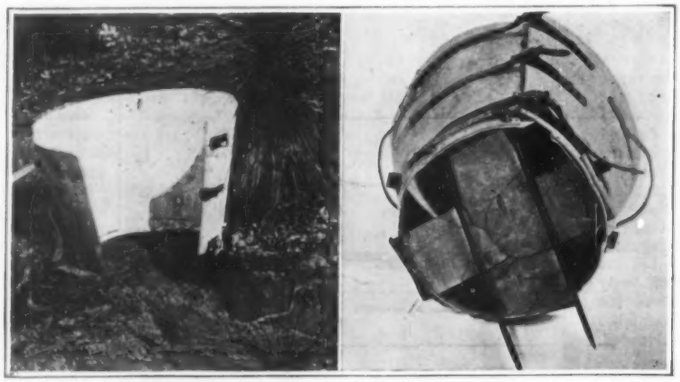
IN order to facilitate the changing of headlights from bright to dim and thus promote road courtesy without incurring the slightest inconvenience or danger, L. W. Auge of New York City has invented the little device shown in the accompanying illustration.

By using the simple device shown, the headlight control may be placed right on the steering wheel, always within ready reach of the driver who does not have to remove his hands from the steering wheel. When parking the car in a place where only a tail light is needed, this may be accomplished by raising one of the buttons on the switch box, thus leaving all headlights dark and only the tail light on. The switch does not interfere in any way whatever with the dash switch. Either switch can be operated independently. The device is so simple that it may be readily attached to any standard automobile in a short time without changes of any kind.

## Making Evergreen Transplantation Practical

TRANSPLANTING anything from a head of lettuce to a large evergreen is always a fussy job and one that is not always successful. In fact, with the large plants and trees transplanting becomes difficult and problematical, especially in the case of evergreens which often die after being transplanted. This is attributed to the fact that the sacking enclosing the roots and earth ball forms more or less a flexible container, and the jars incidental to transportation quickly cause the earth around the vital roots to become loosened therefrom with serious or even fatal results.

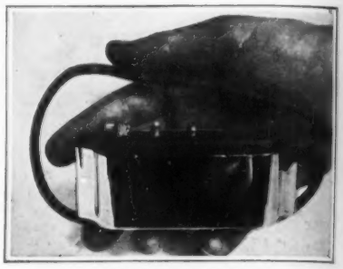
With these facts in mind Lionel Weil of Goldsboro, N. C., has invented a transplanting receptacle which may be employed in transplanting all types of plants but more particularly trees of a less heavy nature. The receptacle consists of a metal casing, properly hinged, which is placed around the roots and earth ball of the tree to be transplanted. Metal slides at the bottom of the receptacle prevent the dirt from falling out of the tapered receptacle. Straps and buckles hold the earth ball firmly in place. In transplanting the tree a hole is first dug, after which the tree or plant with the receptacle still about it is placed in position. The bottom slides are removed, the buckles undone, and the receptacle removed, following which earth is packed around the earth ball containing the unimpaired roots. Even long-leaf pines, which are among the most difficult trees to transplant, have been handled with this device.



**Metal receptacle for transplanting difficult plants and trees after removal from long-leaf pine tree, and the device alone**

## A Dustless Mop for the Dusty Job

IT has remained for C. Juska of Rochester, Minn., to invent an ingenious cleaning device and bucket, which is shown in the accompanying illustration. The mop and the bucket are light in weight and are adaptable to many different cleaning operations about the home, shop, hospital, factory and so on.



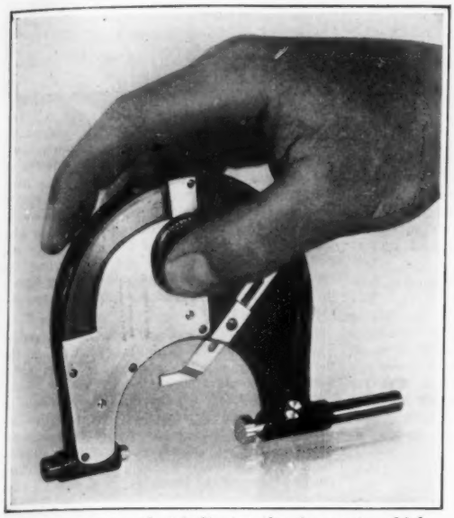
**Tiny switchboard which may be mounted on automobile steering wheel for controlling lights**

The bucket is filled with water to a depth of about one inch above a screen. To free the mop of its dust and dirt, it is placed on the screen and moved gently back and forth several times so that the dirt is loosened from the cleaner head and passes through the screen to the water below. If the mop has been used wet for washing operations, it may be cleaned in the water and then wrung out by placing it on the roller as shown in the illustration, and rolling it back and forth to squeeze out the water.

The house cleaner can be used with a rag instead of a mop if desired, since the holder is arranged to take any form of cleaning member. The angle of the cleaning surface is adjustable with relation to the handle, so as to work in any position.

On account of the screen in the bucket, which acts as a perforated washboard through which the dirt settles and stays in the water below it, the cleaner is readily kept clean while in use as a mop, or when cleaning walls. Again, after it has been used dry for cleaning walls or oiled for polishing floors, it can be easily and thoroughly washed in hot, soapy water and wrung out without being touched by the hands of the fair and gentle operator.

**Wringing out the combination mop and duster by pressing it over the roller**



The snap gage that indicates the degree to which the piece is short or over the standard

## A Reading Limit-Gage

THE use of two snap gages, or a double gage with one opening set to "go" and the other for "not go" will be made unnecessary by the reading limit gage illustrated herewith. This is set, just as is the "not go" member of the customary pair for the smallest diameter tolerable in the piece under test. But instead of being rigid or set so that the operator can merely tell whether the piece went clean or not, the movable jaw has sufficient play so that any piece which the machine can be conceived of as turning out will allow itself to be forced into the opening of the gage. When this has been done, however, the pointer on the scale indicates the extent to which the minimum tolerable size has been exceeded. In many instances this is a preferable procedure for ordinary testing to the simple go and not-go type of gage; while in other cases, where it is necessary to classify the acceptable parts so that elements of the completed machine which are all "fat" or all "thin" or alternately the one and the other may be paired off, it is of extreme value. Cylinders, for instance, may be classified as over-sized, normal and under-sized, all three falling within the extreme limits of toleration; and if pistons are similarly classified, a large piston may be assembled in a large cylinder and a somewhat better engine produced than if assembly were entirely indiscriminate. Indeed, this procedure often admits of the enlargement of the toleration limits without impairing the product in any way.

## The Power-Driven Eraser

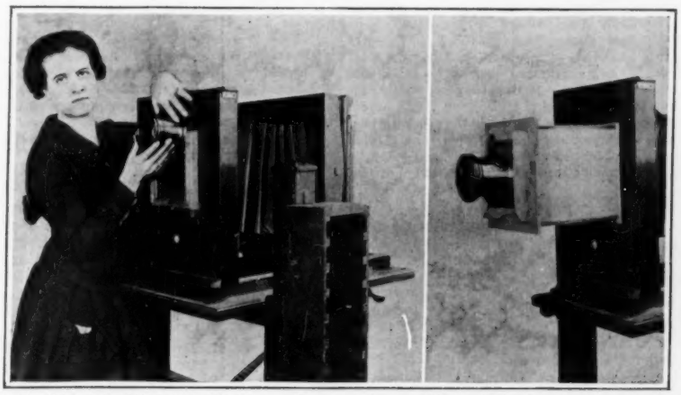
EVERYBODY has had experience with the difficulty of effecting a clean erasure of ink marks that shall leave no trace of the operation in the form of a broken surface that smudges the moment a fresh line is attempted across it. An ingenious architect has concluded that the trouble lies with the means ordinarily employed to produce the power behind the instrument, rather than with the eraser itself; and he has adapted the electric motor to drive the familiar circular eraser, much on the order of the dentist's drill. The apparatus as we illustrate it is a home-made one, the base being an old dictaphone motor. It can be attached to any electric socket, and does its work cleanly and quickly, leaving a surface barely marred at all, and easily capable of taking further ink lines without spreading.

## "Watch Your Hat and Coat"

THE signs exhorting the patron of restaurant and barber shop to check his garments with the cashier or keep his eye on them will be a thing of the past if a recent English invention becomes of general use. The weight of the overcoat on the hook releases a little trip, which allows the long, straight member (seen projecting at the top of the unoccupied hook in our photograph, and resembling a railroad spike in shape) to drop into contact with the broad, flat part of the hook. The overcoat is then locked on the hook and can be released only by a key corresponding in number with the hook. It will be noted that this device will operate equally well with a coat that is properly hung by its hanger, and with one that is hung over the end of the hook in the absence of the hanger or in the frequent event that this is broken. In this case the coat itself is pinched between the spike and the hook. A second retaining member swings over from the back of the frame and clamps the hat in place in similar fashion.

## The Photographer's Handy-Andy

THE commercial photographer who has on his shelves a wide choice of lenses, and whose work calls for intelligent selection among these, uses up a lot of time in putting them on and off his camera in the accustomed fashion. Two simple attachments illustrated on this page will materially lessen the time thus spent. One of them is an ingenious device for lengthening the draw on a camera where a long-focus lens is employed. This consists merely in an extension to the front board of the camera, which makes possible the use of a lens of much longer focus than the machine was designed for. The other is called by the photographer responsible for it the "master front-board." It consists of three strips nailed to the regular front board of the instrument, with a large opening at the fourth side of the quadrilateral, and with the strips cut away on the inner sides to form a flange in which the front boards of the lenses can be slipped. This makes it possible to change lenses in a jiffy without the slightest fuss or trouble. The ordinary practice is to mount the vision lenses on different lens boards, which must be shifted with the lenses.



*Left:* Master front-board facilitating exchange of lenses. *Right:* Extension front-board that enlarges the scope of a single box.

Two handy contrivances for the photographic laboratory

## Obstinate Fruit Stains on the Skin

THE obstinate stains produced upon the skin of the fingers by many fruits and certain vegetables, particularly potatoes, have recently been made the subject of a special scientific investigation by microscopical and chemical means, which produced results both interesting and surprising. In one experiment microscopic sections of human skin were prepared and placed in an aqueous extract of potatoes. When examined through the microscope the observer was astonished to perceive that the outermost layer of the skin, the cuticle, was not colored by the potato extract. It was a deeper lying layer, the germinal layer, which is composed of epithelial cells which is colored; the layer below this, the "true skin" which is technically known as the corium and is sometimes called the "leather layer" does not change color. Hence the section of skin seen under the microscope shows a narrow, sharply defined, dark line lying between the non-colored epidermis and the non-colored corium.

Evidently, therefore, this middle layer or epithelium possesses a special capacity for uniting with the dyestuff contained in the potato. This is all the more interesting because it is this layer of cells which contains the pigment which produces the darkness of the skin in brunettes and the so-called colored races. Curiously enough, the skin was stained intensively even when the potato extract was not itself very dark but merely pinkish in color.

Puzzled by this phenomenon the experimenter continued his researches and found that the potato extract undergoes, upon exposure to air, a series of changes in color, passing through the various shades of reddish yellow, mahogany brown and violet blue, and finally, becoming quite black. Besides passing through these various changes of color, the extract, which when first made was comparatively clear, becomes increasingly cloudy and less and less transparent until finally, the black coloring matter within it is so dense and heavy that it forms a precipitate at the bottom of the vessel.

This change of color can be considerably accelerated by the addition to the extract of certain metal compounds of a basic character—metallic oxides, for example. According to Dr. Robert Willheim of Vienna, to whose article in *Die Umschau* (Frankfurt) we are indebted for an account of these experiments, this last experiment plainly indicates that there is catalytic action involved. Thus, the cells of the epithelium behave precisely like the powdered oxide. That the catalytic action is not due to any sort of enzyme or ferment located in the epithelium is proved by the fact that the decoloration takes place even when the section skin has been previously boiled. We are justified in concluding, therefore, that the epithelial layer of the human skin possesses certain elements which are capable, like metal oxides, of attaching to their upper surface certain substances, especially of a colloidal nature, particularly when they possess an acid character, and which are, therefore, capable of strengthening the union made by absorption through chemical action also.

The motor-driven eraser and its manner of use

Hat-and-coat hook that locks on the garments entrusted to its care

# Recently Patented Inventions

*Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.*

## Pertaining to Aeronautics

OBSERVATION KITE BALLOON.—E. PRASSONE and L. AVORIO, Rome Italy. The invention relates to observation kite balloons of the type in which stability is maintained by the action of the wind meeting the balloon combined with the pull of the mooring rope. The device consists of a gas container or bag of moderately elongated shape connected with a conical or pointed appendage with stabilizing or rudder bags, the rudder bags being filled with air.

## Pertaining to Apparel

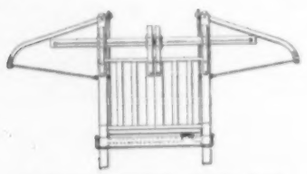
GARTER.—R. A. MANNY and J. A. RIELLY, 108 Worth St., New York, N. Y. The object of the invention is to provide a garter more especially designed for holding up socks in a very simple manner, and without the use of hooks, the garter being wholly devoid of metal parts, clamps or similar fastening devices. Another object is to permit of conveniently placing the garter on the wearer's leg and in engagement with the sock to be held up.

## Electrical Devices

CIRCUIT BREAKER.—G. O. O. DAVIES, Cle Elum, Wash. The invention relates to an automatic electro-magnetic, overload circuit breaker of compact form adjustable to plug fuse receptacles, to be employed in house lighting and other electrical circuits. The objects are to provide a more efficient device for the protection of electrical circuits from the damage wrought by over loading or short circuits, to provide for readily determining which circuit breaker has broken the electrical circuit, and to provide means for easily completing a circuit which has been broken.

## Of Interest to Farmers

GATE.—D. M. MCCAULEY, Pastor Presbyterian Church, Toas, N. Mex. More particularly the invention relates to mechanism for gates, an object being to provide a gate normally positioned across an entrance or railway crossing, which automatically opens to



A FRONT ELEVATION OF THE GATE

allow an automobile or other vehicle to pass through and automatically closes after the vehicle has passed, without necessitating the driver's alighting. The gate is held by locking means which must be released by the weight of the vehicle, and will resist manual operation.

## Of General Interest

ANIMAL TRAP.—E. E. KOHL, c/o L. J. O'Marr, Barr Bldg., Sheridan, Wyo. The invention relates more particularly to a trap adapted for catching gophers. The object is to provide a trap of this character which is of simple and durable construction, reliable and effective in operation and easy and inexpensive to manufacture.

ANIMAL TRAP.—W. F. LANGE, Box 34, Runge, Texas. The object of the invention is to provide a trap especially adapted for use in the extermination of mice and similar rodents. A further object is to provide a trap of this character of extremely simple construction, highly effective in use and easy and inexpensive to manufacture.

RUG EXTRACTOR.—A. P. MAISE, 734 Hamilton St., Allentown, Pa. The invention relates to a device whereby a single rug may be drawn or extracted from between piles kept on sale in rug and carpet stores for the purpose of exhibition or sale. An object is to provide a simple and effective device by which the rug may be extracted and at the same time rolled around a pole to keep the rug in shape and permit more convenient handling.

ALLOYS.—F. MILLIKEN, 110 William St., New York, N. Y. Among the objects of this invention is to provide an alloy characterized by a high resistance to the corrosion of acid and capable of withstanding high temperatures. A further object is to provide an alloy especially serviceable for use in the manufacture of still plugs and other fittings liable to be subjected to the action of acids. The alloy is composed as follows: Copper, 45-55%; nickel, 29-35%; lead, 1-3%; zinc, 5-9%; iron 4-8%; silicon, approximately, 30%.

BED.—J. P. DIECKMANN, Route 2, Oakfield, Wis. An object is to provide a bed which will give readily with the weight of an occupant. A further object is to provide a bed in which the spring and mattress instead of being sup-

A PERSPECTIVE VIEW OF THE BED

ported upon the side bars of a bed frame are supported on a frame suspended from a cross bar attached to the head and foot pieces of the stationary bed frame. Springs support the frame which is adapted to sink downwardly with the weight of an occupant.

CURTAIN HOLDER.—L. B. GARRABRANT, 61 A. S. Elliott Place, Brooklyn, N. Y. An object of this invention is to provide a curtain holder arranged to permit the user to readily and quickly fasten the holder in position on the window frame without the use of separate screws of similar fastening devices. A further object is to provide component parts, including means for fastening the holder, attached to one another to prevent loss of any of the parts.

MAGAZINE BINDER.—F. H. CRUMP, 225 E. 4th St., Los Angeles, Cal. The invention has for its object to provide a binder within which a magazine may be readily secured and which will not only protect the magazine, but will support the same in condition to be more readily read. Another aim is to provide a clamping element so constructed that it will bind a magazine whether sewed, wire-stitched or otherwise held together.

CRAYON HOLDER.—P. M. BIONDO, 72 Throop Ave., Brooklyn, N. Y. The object of this invention is to provide a crayon or chalk holder more especially designed for use in schools and other places, to securely hold a crayon or piece of chalk in place while writing or drawing on the blackboard. The holder permits of readily adjusting the crayon and is simple and durable in construction and cheap to manufacture.

INSECT CATCHER.—B. R. JOLLY, c/o Raleigh Savings Trust Co., Raleigh, N. C. This invention relates generally to insect catchers and more particularly to a mechanical suction trap, an object being the provision of a manually controlled and manipulated device, by means of which flies, mosquitoes and other small insects may be readily and easily caught, trapped and killed.

CHECK PROTECTOR.—A. C. WOODRUFF, Burns, Oregon. The particular object of this invention is to provide an implement for printing and perforating checks for safety purposes, the device being adapted to be readily carried in the pocket, it being relatively small and compact. The implement is so arranged that the check may be stamped, perforated, and automatically advanced during each operation.

PORTABLE BURGLAR ALARM.—S. SUNDEL, address M. Strachansky, Thompson and Foron Rd., East Haven, Conn. Among the objects of the invention is to provide a portable burglar alarm for the use of travelers and other persons, and arranged for convenient attachment to a door, window or other movable part with a view to sounding an alarm on the movement of such part. Another object is to allow of setting the alarm to keep on sounding should the door be closed again after the alarm is started.

COMPOSITE AUTOMATIC FIREARM.—W. E. ROSEBUSH, c/o Inland Empire Paper Co., Millwood, Wis. The invention relates to recoil-operated, breech-loading hand firearms. The object is to provide a composite automatic hand firearm which can be readily changed for use in target practice or for service by the use of compartively inexpensive interchangeable parts to accommodate the various cartridges of the hand firearm type which are of various caliber and power.

CAMERA.—M. OCHOA, address Rapael Restrepe, 21 Park Row, New York, N. Y. The invention has for an object to provide a camera wherein a large number of exposures may be made while using a comparatively small construction. Another object is to provide a construction where the same lens is used for the finder and for the main focusing lens. A further object is to provide a camera which is so small that it may be used openly, or covertly in a hand bag.

PORTABLE DIFFUSION APPARATUS.—R. MOULIN, 35 Rue Brulen, Paris, France. The invention relates to apparatus for the diffusing of essence or volatile liquids, and it comprises a hermetically closed receptacle, containing the liquid and having a wick immersed therein and extending out through the metal stopper, so that the liquid is drawn out by capillary attraction. The apparatus is contained in a metal case, the cover of which is pierced with small holes, thus permitting the vapors to escape, but protecting objects from all contact with the impregnable wick.

COMBINATION FILTER PRESS AND DRIER.—J. J. NAUGLE, 300 Macon St., New York, N. Y. An object of this invention is to provide an automatically filtering filter press in which the residual cake may be discharged without the aid of a fluid. Another object is to provide a filter press having a sectional housing, the stationary part of which presents a supporting wall for the filter plates and from which plates the cakes will detach under its own weight as soon as the movable sectional parts of the housing is displaced.

## Hardware and Tools

PLUMBER'S FERRET.—C. W. SHEATSLEY, c/o Pensacola Shipbuilding Co., Pensacola, Fla. The object of this invention is to provide a construction in the form of flexible pliers which can be bent around a bend, or variously positioned to grasp and remove obstructions. The device is extremely simple in construction, and is strong and durable in use.

TOOL.—F. H. HILLARD, 401 S. Main St., Fitzgerald, Ga. This invention has for its object to provide a tool especially adapted for use with motor vehicles, wherein a blade is provided having a handle provided with an offset portion, forming a stop, for permitting the tool to be used as a jack pedal, the blade being adapted for moving dirt, or the like, and having openings to permit the tool to be used as a wrench, and either the handle or blade serving to assist in removing or replacing a tire.

COMBINED KEYHOLE GUARD.—J. SOMORA, 362 N. Avers Ave., Chicago, Ill. An object of the invention is to provide a keyhole guard adapted to be applied to a lock of ordinary construction and having means movable relative to the keyhole of the lock, and means controlling the operation of a shutter which prevents or permits the insertion of a key into the keyhole.

## Heating and Lighting

WATER HEATER.—F. J. CLIFFORD, Pateros, Wash. Among the objects of the invention is to provide a device especially adapted for vaporizing water, wherein the heating element is interposed in an electrical circuit normally open and adapted to be closed by the unvaporizing water, the arrangement being such that when the water is all vaporized the circuit will be broken.

## Machines and Mechanical Devices

GEAR CUTTING ATTACHMENT FOR MILLING MACHINES.—M. FOGDE, 2000 Beverly St., Richmond, Va. The invention relates generally to gear cutting devices, but more particularly to attachments for milling machines for cutting bevel gears, the prime object being the provision of a device which will automatically cut and counter the teeth of bevel gears in such manner as is now impossible on machines of this character.

SPEED INDICATOR.—J. R. SMITH, 1811 Center St., Calgary, Canada. The object of the invention is to provide a device especially adapted for use with aerial or marine vessels, for measuring and indicating the velocity of the moving object with respect to the fixed object, wherein a device is provided to enable the observer to retain the sighting device on the fixed object, and indicating mechanism controlled by the swinging of the sighting device, and wherein the relative speed arm and the recording mechanism is capable of being varied in accordance with the altitude or with the range.

LAWN MOWER.—G. WOOD, 1548 W. 61st St., Seattle, Wash. This invention is of the monocycle type and includes a novel drive from the single running wheel to the rotary cutter in a way to cut close to a fence or hedge. Provision is made for the cutter accommodating itself to any unevenness of the ground without affecting the drive connection. The cutter is optionally raised or lowered by turning the cross bar of handle to wind or unwind a chain.

TEXTILE FINISHING DRUM.—J. LUNEFF, South River, N. J. This invention refers more particularly to mechanism for the treatment of laces and embroideries. An object is to provide a finishing drum upon which lace or embroidery may be wound for the final treatment in various solutions followed by drying, and to prevent the lace which is wound upon it from shrinking.

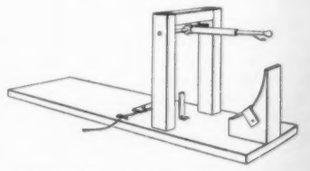
APPARATUS FOR THE DEVELOPING, ETC., OF FILMS.—R. C. HUBBARD, c/o Erbograph Co., 203 W. 146th St., New York, N. Y. This invention has for its object to provide a machine whereby motion picture films are run back and forth, in developing, washing and fixing, the desired period of treatment in each operation being reliable. An important feature is that the film travels horizontal in its runs back and forth, whereby a shallow tank can be employed, and the film at any time can be fully observed.

CLAMP DOG.—A. P. MILLER, 145 W. Vermont St., Indianapolis, Ind. A particular object of the invention is to provide a clamp dog especially adapted for use with grinders or lathes. A further object is to provide a dog or driver which is adjustable and otherwise so constructed and operated as to exert a powerful, effective gripping action on the work to transmit the required rotation to the work without marring the surface of the same.

SIGNALING DEVICE.—I. B. WALKER, Etna Mills, Cal. The object of this invention is to provide mechanism of the character specified adapted to be arranged on highways for warning drivers approaching each other from opposite directions, at dangerous places in the road, wherein each car as it approaches the danger point, operates the mechanism which controls the signal at the opposite side of the danger point, for a specified length of time.

ATTACHMENT FOR COAL CONVEYORS.—C. G. WALKER, Bramwell, W. Va. The invention relates generally to coal mining machinery, and particularly to an attachment for stationary or movable conveyors, the purpose being the provision of a simple and inexpensive device which can be readily attached to a conveyor for automatically controlling the passage of coal therefrom to prevent breakage of the coal and to uniformly distribute the coal to a second conveyor.

FIRE IGNITER.—H. PIERCE, Box 166, Paragould, Ark. An object of the invention is to provide mechanism for igniting fires at a distance. A further object is to provide a trig-



A PERSPECTIVE VIEW OF THE IGNITER

operated match lighter which may be placed at the point where the fire is to be lighted and controlled by an operator who may be some distance away. The device is practical and durable, and may be manufactured at a relatively low cost.

KEY BOARD FINGER GUIDE.—I. HILGUERA, 10 S. Broad St., Trenton, N. J. This

*(Continued on page 34)*

## The Giant Junk Yard

(*Continued from page 20*)

into the ground just alongside the mountain of scrap, which is brought in from all over the country and unloaded by magnets—it is tin-plate with an iron base, of course. The shavings are forced into the chamber of the press and compressed into a block eight by twelve by twenty inches. In this form manufacturers buy the stuff for resmelting. Thousands of tons of it are used every year.

The Philadelphia company has been best known to the general public for its marine work in salvaging vessels, because of the spectacular nature of this pursuit and the fact that famous old fighting ships fall into its hands. Its specialty, however, is the purchase of any kind of metal junk that the ordinary dealer is not equipped to handle. The company will buy the lightest or the heaviest scrap in the world. It has torn down hundreds of bridges. Recently its workmen swept away every trace of the old Columbia Bridge over the Schuylkill River at Philadelphia in less than sixty days. This iron structure was put up at the time of the Centennial Exposition and has now been replaced with a modern bridge.

The firm also buys railroads and trolley lines—including everything from ties to power plant. A single sixteen-wheel trolley car now stands on a side track in the yard to bear witness that there was once a trolley line called the Cape May, Delaware Bay and Sewell Point Railroad, with eighteen miles of track, its own power station and right of way and twenty cars. The junkman bought everything but the right of way, repaired and sold some of the cars, smashed and cut up the others for remelting, dismantled the plant and scrapped most of the equipment. The company also bought and dismantled the electric railroad from Danbury, Conn., to Harlem, N. Y.

Since the ending of the World War this concern has been perhaps the largest buyer in the country of metal ranging from the vicious four-point barbed wire to shell. Recently the last of the shell castings, totaling about twenty-five thousand tons, was shipped to a firm at Glasgow, Scotland, to be melted and used in the manufacture of machinery and tools. All other war material except about four hundred miles of barbed wire and a large number of hydraulic presses built at a cost of $10,000 each to compress powder has been broken up and sold. The barbed wire is being sold to farmers all over the country. It was meant to guard the trenches of the Allies, but it was never sent abroad.

There is, of course, a large quantity of nickel-steel armor. Most of the tonnage of this kind now in the yard came from the monitor Amphitrite, but there are also some remnants of the battleship "Iowa" in the shape of armor and fighting masts. All of this material is cut up with the oxy-acetylene torch and sent back to the foundries for remelting. Plates and bars of steel and iron that contain no nickel are first cut into handling sizes with the torch, and then chopped up in huge shears the jaws of which will bite through six square inches of steel.

In general it may be said that there is no specific use for the different types of iron and steel scrap. All of it goes to the foundry and the steel plants to be melted over again. It is the practice in these mills to use the old metal in combination with a new ore—just as reworked wool is used with new wool in the making of clothing. It is then used in the manufacture of machinery—even in tools that are put to hard use. No one knows just what form the locomotive may take after the junk dealers have broken it into sizes suitable for the furnaces. Parts of it may go back into the same service and other parts may go into bridges or skyscrapers.

In some cases, however, the concern has discovered specific markets. It is the custom of wire mills, for instance, to draw wire to a certain bundle-length, and frequently an ingot from which the wire is being drawn will not be large enough to complete the last bundle. At other times the wire breaks. This results in what are called "shorts," which are sold as scrap. The junk yard contains about a thousand miles of this wire, for which a ready market has been found only within the last few years. Inquiry throughout the world brought to light the fact that three or four Chinese and Japanese firms are buyers of this material. They dispose of it in small lots to native metal workers who use it in the construction of various novelties. Buyers of this material send out definite specifications for what they want. They buy one hundred tons of used American horse shoes at a time, for instance, and these are melted up by the smiths and used in making razors, pen knives and novelties.

The scrap yard has a sky line all its own to one walking between the towering piles of metal junk. One such pile consists of all sorts of curious shapes, some of which weigh forty and fifty tons. These are the "skulls" from steel plants, which is the name given to metal that runs over the top of the mold, or the metal which hardens in a furnace because of an accident. The total amount of this steel in any one plant is too small for the manufacturing company to bother with. Skulls accordingly are bought by this yard to be broken up for the furnaces.

A five-ton weight mounted on a derrick mast is used for most of the breaking up. Under this treatment the stoutest boiler or other piece of machinery soon becomes unrecognizable and ready for the fire that will reconvert it into something useful. In this connection, no machine is scrapped that is susceptible of salvaging. The company operates a machine shop where locomotives, road rollers, sewing machines and virtually everything else that can be induced to move is rebuilt, where possible, and sold for continued use. A large percentage of the metalplate scrap obtained is used for the manufacture of washers in all sorts of shapes and sizes. This company made all the washers used in the construction of the Panama Canal.

Some of the workmen engaged in the dismantling of plants become as expert as lumber jacks in their own line. It is a boast of the company that its men can drop a smoke stack within five feet of any given point. Various methods are used for this work. Foundations are cut away on one side and dynamite is used in some instances. Where that is impracticable foundations are replaced with timber underpinning until the stack can be expected to topple of its own weight when these are removed. The timbers are then burned away. For tearing down gas holders the company uses a special axe which cuts through wrought iron as though it were light wood.

A metal junk yard may be likened to a history of the early days of industry. But it touches other things besides the romance of business. The company, some years ago, dismantled the power house of Sing Sing prison. And even the big dynamos used to execute the first of the New York gunmen are now serving some useful purpose. They were dismantled, broken up and sold to be remelted. Sooner or later some use is found for every pound of metallic scrap that is kept off the dump heap.

## Weapons at Sea

(*Continued from page 25*)

torpedo hits are, generally, in spots unprotected by armor. Again, in the case of torpedoes, the explosive effect is enhanced by the inertness of water, for, by water pressure, the full force of the explosion is transmitted to the attacked ship's hull.

(*Continued on page 35*)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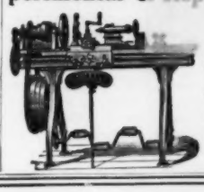

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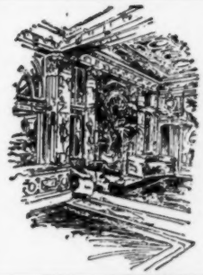

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## RECENTLY PATENTED INVENTIONS

*(Continued from page 32)*

invention relates to instruments having manually operated keys such as typewriting and typesetting machines in which the keys are arranged in banks or associated rows. Among the objects is to provide means to enable the learner to quickly and easily master the key board for the manipulation of the machine under what is commonly called "the touch system."

MACHINE FOR SHREDDING BAMBOO AND THE LIKE.—A. H. WILLIAMS, Plant City, Fla. This invention relates to a machine for shredding bamboo for the purpose of making brooms. A further object is to provide a machine which in one operation makes straws out of which brooms are to be manufactured, wherein the bamboo or similar material is shredded by reciprocating lengths thereof over suitably arranged means for accomplishing the purpose.

SPOOL RACK.—R. BLACK, 2132 Mohegan Ave., Bronx, N. Y. This invention particularly relates to spool racks for use in connection with warping mills or weaving machines. The principal object is to provide a spool rack which is so constructed as to permit of the combined use of a sufficient number of racks in connection with a warping mill or a weaving machine as to run the mill simultaneously the required number of threads for the maximum width of the cloth in one operation.

KNIFE FOR CUTTERS.—H. S. WILLIAMS, 271 Bainbridge St., Brooklyn, N. Y. This invention pertains more particularly to machines employed for trimming paper. The primary object is to so construct the knife carrier as to greatly facilitate the operation of placing the knife therein and removing the same therefrom. By this method the danger of accident in the operation of attaching and detaching heavy knives is greatly reduced.

### Medical Devices

DENTAL ARTICULATOR.—J. HOMER, c/o Thomas A. J. Drady, 704 Parker Ave., Roxbury, Mass. An object of this invention is to provide an apparatus which materially reduces the time and labor required to manufacture sets of false teeth. Another object is to provide an apparatus whereby a set of false teeth may be made which, when inserted in the patient's mouth will result in the maintenance of natural facial expressions, both in repose and in the movements of the features.

### Musical Devices

PHONOGRAPH.— C. A. PETTIT, 3133 N. Sarah St., St. Louis, Mo. The aim of this invention is to provide a device more particularly known as a magazine phonograph. An object is to provide a receiving compartment or magazine adapted to accommodate an almost unlimited number of records. A still further object is the construction of a machine in which any records may be instantly available for reproduction and in which it will not be necessary for the operator to handle any of the records.

MUSIC-LYRE HOLDER.—W. C. REID, 611 W. Crawford St., Elkhard, Ind. This invention relates to musical racks and more particularly to holders such as are used on band instruments. An object is to produce a holder for use on such instruments as a clarinet and the like in which the lyre portion is held securely to the support without the use of set screws such as are commonly used, but having a clamping ring to include the body of the instrument.

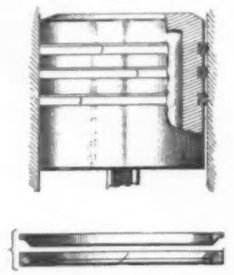
VIOL.—A. F. GROENL, E. Main St., Oyster Bay, N. Y. The object of this invention is to provide a viol, wherein a strong, simple structure is produced capable of resisting rough use. A further object is to provide what may be termed a combined violin and banjo, the parts being so arranged that the violin shape and general characteristics are retained while the banjo head is provided and held in place regardless of weather conditions.

### Prime Movers and Their Accessories

GAS ENGINE.—W. E. DEISCH, Bremen, Ind. This invention relates to gas engines of the multi-cylinder two-cycle type. An important object is the provision of an engine in which is provided a novel port and passage arrangement for effecting the transfer of a charge from the compressing and charge forming section of one cylinder to the explosion section of the next adjacent cylinder, the invention being adaptable for use in connection with any tw-cycle motor having an even number of cylinders set side by side in parallel relation or arranged as in a V-type motor or in opposed relation.

COMBINED SPARK PLUG TERMINAL AND PROTECTOR.—E. H. WEBER, Ranier, Minn. The invention has for its object to provide a device wherein a one-piece combined terminal and protector is provided for conveniently attaching the wire to the plug without tools or solder, and without the possibility of receiving a shock from contact with the parts. A fgurther object is to provide a device for preventing the terminal from becoming detached from the spark plug accidentally.

PISTON RING.—J. O'NEAL and J. F. HARPPNER, Box 107, Granite City, Ill. A purpose of the invention is the provision of a piston ring adapted for use on internal combustion engines comprised of two rings associated with



A PORTION OF A CYLINDER AND PISTON AND RINGS IN SECTION

each other in such manner that when in applied position one of the rings is actuated by the pressure of gas to expand the other ring into snug engagement with the walls of the cylinder and thus effectively prevent leakage.

### Railways and Their Accessories

CONCRETE TIE.—A. C. RAPELJE, Box 288, Harrisburg, Pa. Among the objects of this invention is to provide a tie, wherein the body of the tie is composed of reinforced concrete, having at each end a rail seat across which the rail extends, said rail seat being of fibrous material and being anchored to the tie by the same means which connects the rail to the tie.

ENGINE INDICATOR.—L. E. HUNT, 935 Hamilton St., Springfield, Mo. The object of this invention is to provide mechanism for use in engines of any character for indicating and recording the steam pressure at any port, the direction of movement and the relation between the operation of the valves and the said movement.

### Pertaining to Recreation

PUZZLE.—J. V. WELLS, 161 W. 36th St., New York, N. Y. An object of the invention is to provide a railroad puzzle which will be instructive and highly amusing to both old and young. Another object is to provide a simple construction for the puzzle which may be easily and cheaply made. The object is to reverse the position of two trains by manipulating the switches.

COMBINED GAME AND EDUCATIONAL DEVICE.—F. GOTSCHE, 416 Hoffman Ave., San Francisco, Cal. The principal object of the invention is to construct a game apparatus wherein a part is revolved for the purpose of

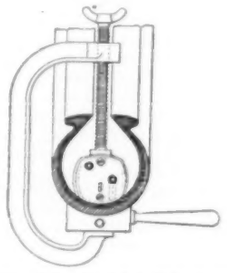
A TOP PLAN VIEW AND CROSS SECTION

propelling game pieces so that the same may fall into pockets denoting various numbers or characters. The game may be played by a number of persons, and being of simple construction may be pinced on the market at a reasonable cost.

### Pertaining to Vehicles

VEHICLE LIFT.—L. F. NADIG, Quakertown, Pa. Among the objects of the invention is to provide a lifting device for vehicles which may be readily installed to raise the vehicle above the floor surface, to permit access to the lower and under portion of the vehicle without requiring a substantial portion of the floor to be cut away.

VULCANIZING MOLD.—O. M. FREDD, Hancock, Mich. The invention particularly relates to repair devices for tires. The prime object being the provision of a device of this character, which is capable of use with tires of different dimensions. A further object is to pro-



A SECTIONAL VIEW OF THE DEVICE IN USE

vide a device in which the heating medium used is steam and in which the construction is such that the water of condensation may be properly carried off from within the heating chamber.

FIFTH WHEEL.—M. A. MORSE, JR., 603 Perrier St., New Orleans, La. Among the objects of the invention is to provide a fifth wheel supported on an elastically cushioned vibrating plate, and having a rocker shaft thereon providing pivotal mounting for a trailer section so that all thrusts, shocks and jars are absorbed regardless of the angle of the trailer section, or the condition of the road or angle of the turn.

COMBINED BUMPER AND LOCKING DEVICE.—W. H. CRISWELL, c/o Country Club Orchard, Merlin, Ore. The object of the invention is to provide a combined bumper and locking device for use on automobiles and other power driven vehicles and arranged to permit the use of the bumper at the front end of the vehicle for the usual purposes or for holding the front or steering wheels in locked position to prevent steering of the vehicle.

AIR SPRING.—J. J. ISLER, Kipling, Mich. An object of the invention is to provide mounting for a pneumatic cushion which will entirely enclose the cushion and which will permit the latter to freely function to absorb

A VIEW IN LONGITUDINAL SECTION

shocks and vibrations and give resilient support in any position in which it is used. A further object is to provide a construction which is substantially watertight to prevent injury to the cushion through contact with atmospheric conditions.

MAGNETO CONTACT.—V. RIGSBY, Hamphill, Texas. This invention particularly relates to a contact which may be used to advantage with the usual type of Ford magneto. An object being to provide a contact which may be quickly and easily removed, cleaned, and replaced, and also one which will not make short circuits between the contact and the magneto.

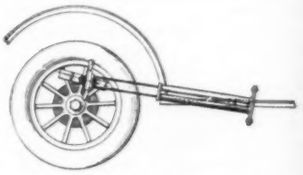
HYDRAULIC STEERING GEAR. — H. B. CRUM, c/o Bucyrus Machine & Tool Co., Bucyrus, Ohio. The invention relates to steering gear for vehicles. An object is to produce a type of hydraulic steering gear for use on motor cars to supplant the present used worm and worm wheel type, or worm and segment type of steering gear; to this end the inventor employs a simplified hydraulic pump and fluid motor or actuating means.

ANTISPLASH GUARD FOR MOTOR VEHICLES.—L. E. VASSEUR and M. TCHOUBRITCH, 62 Rue da Louvre Viroflay, Seine et Oise, France. The object of this invention is to provide a guard intended to prevent the splashing of liquid mud outward; to accomplish this a brush is carried in a frame suspended from two vertical arms hinged on a plate which is adapted to move vertically and to swing on a plate secured to the chassis of the vehicle by arms which also support the brush frame by means of springs.

SWITCH LEVER OPERATING MECHANISM.—H. D. BLUMENFELD, P. O. Box 54, Haverstraw, N. Y. The primary object of this invention is to provide means for operating the ignition switch when the same is placed on the exterior of a box which in turn is carried by the dashboard of the vehicle. A further object is to so construct a device that such switch may be operated from a point adjacent the steering wheel of the vehicle.

ADJUSTABLE TRACTIVE ATTACHMENT FOR TRACTION WHEELS.—R. D. BALLARD, 100 Central Ave., St. Petersburg, Fla. More particularly this invention relates to traction wheels of heavy vehicles; the object is to provide an inexpensive attachment of an adjustable nature, whereby to provide for the necessary grip upon roadway surfaces under varying conditions. Generally speaking the invention provides the use of radial adjustable tractive members whose outer ends are projectable through the rim of the wheel.

POWER ATTACHMENT FOR AUTOMOBILE HAND PUMPS.—C. C. MOHNEY, c/o Book Supply Agency, Clintonville, Pa. This invention relates to tire pumps of the ordinary character for automobiles, and has for its object to provide mechanism for connecting the pump to a motor vehicle in such manner that



A VIEW SHOWING THE PUMP IN PLACE

when a rear wheel is jacked up and driven by the engine the pump will be operated, the pump being connected with the spokes of the wheel and the running board, making an engine-driven pump quickly and easily attached for inflating any tire on the car, either on the road or in the garage.

CANOE TRAILER FOR MOTOR VEHICLES.—D. B. WOODRUFF, Nesta Vista Ranch, Olathe, Colo. The invention has for its object to provide means whereby a canoe may be loaded with camp equippage, covered with a water-tight and dust-proof cover, wheels placed under the canoe converting it into a wheeled vehicle of the trailer type, and connected to the rear of a motor vehicle to be drawn thereby.

AUTOMOBILE LOCK.—W. F. JENKINS, 1814 Hanover Ave., Richmond, Va. Among the objects of the invention is to provide a simple and durable lock to be operatively associated with the steering wheel and post of an automobile. A further object is to provide a lock of such construction and material that it cannot be broken without great difficulty, thereby discouraging unauthorized removals of the automobile.

AUTOMOBILE LOCK.—J. H. PRICE, Cape Girardeau, Mo. This invention relates more particularly to locks for Ford automobiles. More especially the invention aims to provide movable locking arms with extensions engageable with one of the radial ribs or spokes of the steering wheel so that when these arms are locked the steering wheel will be securely held against rotative movement in addition to the locking of the spark and throttle levers.

### Designs

DESIGN FOR A MOTOR VEHICLE RADIATOR.—V. W. PAGE, 309 Lafayette St., New York, N. Y.

DESIGN FOR A MUD GUARD.—E. L. TOMLINSON, North Branch, Mich.

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## Weapons at Sea

(*Continued from page 33*)

In considering the case of the capital ship, it must not be taken as a unit, but as a craft of great offensive power for gaining control of the sea, but which has a number of agencies, protective and offensive, to assist and protect it. If the protective agencies are allowed to lag behind the development of a new arm there is no occasion for hysteria concerning the passing of the capital ship; instead, there must be concentration on the provision of defense measures to meet the new menace. As in the past, you did not send out a battleship devoid of armor; and as in the present you give her a destroyer screen against submarines; so, in the future, she will have a protective service of fighting aircraft.

Notwithstanding all the hysteria concerning the passing of the capital ship as a type, it must be remembered that the cheapest and most powerful unit weapon is the *gun*. It hurls explosives in large quantities at enormous velocity. The battleship is the type developed to use it at sea. And, the battleship or some other type adopted to carry this weapon, with protection inherent in itself, or in supporting types, against the menace from the air and subsurface, will always control the sea and be the dominating factor in naval warfare as long as commerce moves in surface ships. Should commerce in bulk and enormous quantities ever move by air, then, and only then, shall we see the battleship displaced as the dominating figure at sea.

However, the havoc made by the submarine against sea-borne commerce in the last war will be duplicated from the air in the next war, if defensive measures are not devised and provided to meet it. As in this war with hostile submarines, so in the next, with hostile aircraft, any country will be at a great disadvantage if adequate air defense for its sea-borne commerce is not at hand.

Aircraft, used as a destructive agency in a sea battle, can be largely discounted as a determining factor, for nullifying provisions will be made, aerially, by both sides before such a battle is initiated. But the use of aircraft on a large scale against merchant vessels will have the same application as the submarine unless measures are at hand for defense, namely, anti-aircraft guns and counter-air-defense. The inability of the aircraft to operate for long periods without the assistance of a floating or land base will mitigate against its use and value. However, the merchant convoy of the next war will need two or more anti-aircraft guns on each ship, and one or more fighting planes on deck, especially when within 300 miles of the enemies' bases. If control of the sea is not already obtained, or if the enemy has carriers or men-of-war at sea, to be used as raiders, merchant ships must carry aircraft at all times.

The fanaticism of the air force advocates is not warranted so far as it calls for the destruction and abolition of surface types, particularly men-of-war or merchant vessels. Economy largely determines trade routes and methods of carriage. Both are susceptible of modification in time of war. Sea-borne commerce, for long hauls, will always, in peace time, be carried in surface craft, since such craft are and must be for this and the next generation the cheapest method of transport over water. No nation can meet, in war time, an economic shortage of fuel or military supplies by air transport or sub-surface craft. An adequate number of such craft would not be built in peace time because of expense.

In war time a cause, already lost, might attempt as a last expedient to stem the flood of disaster with such straws as aircraft freighters alone, but they cannot be a determining factor in resisting economic shortage when control of the sea is lost.

## A Chat with Madame Curie

(*Continued from page 25*)

made an industry of it. Our radium production surpasses by far that of any other country. We have found almost countless ways of putting radium to work, such as illuminating watch dials, locator buttons, house numbers, chain socket pendants, gun sights, instrument dials, and so on. And what satisfaction for Madame Curie to learn, as she very quickly learned, that our methods of extracting radium from the carnotite ores of Colorado are precisely those which Professor Curie, her husband long since deceased, and herself employed in a modest laboratory back some two decades ago when radium was first isolated and studied by itself!

Despite twenty years of study and research devoted to radium and radioactivity, Madame Curie admits that she has much to learn. And if she knows very little about this most interesting of scientific studies, who does? Radium, she tells us, must be handled with great care. Careless or inexperienced handling may prove dangerous and perhaps fatal. We noted that one of her hands had been affected by the radioactive rays and her general health, so she told us, had been undermined as the result of intensified wartime work with radium.

But what will Madame Curie do with her gram of radium, now that she has realized the wish of her life time? That is a difficult question to answer. Even a brief discussion on radium and radioactive properties soon leads to an impenetrable jungle of technology, through which the inexperienced layman cannot hope to pass. So Madame Curie, with a modest smile, could not tell us just what she intended to do with the precious gram. She explained, however, that the Curie Institute in Paris divides its efforts along two main lines, namely, physicochemical and physicobiological, as she terms them. The former has to do with the study of radium and radioactive substances purely from the standpoint of the physicist, while the latter deals with their application to the treatment of human ailments. Madame Curie impressed us as being as much interested in one as the other. Answers to a few medical questions made us feel that her Doctor of Medicine degrees have been most appropriately awarded.

However little Madame Curie may be able to explain to us as regards her future work with said gram of radium, one thing is certain, and that is that she needs rest and plenty of it. She told us the first part of her program called for protracted rest, extending through July and well into August. By September she will be back in the Curie Institute, hard at work on the gram of radium. Furthermore, she intends to carry on an extensive investigation with a large quantity of mesathorium, another radioactive substance, which she has taken back with her.

It was a mighty tired but highly grateful and appreciative woman that sailed for France on June 25th. Down in that holy of holies—the specie room—of the "Olympic" was her precious gram of radium and a quantity of mesathorium, valued at $165,000 in all. Special precautions had to be taken on account of the ship's instruments, for the compasses must not be disturbed in their normal functions. The Bureau of Standards carried out the shipping instructions. A beautiful mahogany case lined with lead and steel was provided. Although the box was not large, it weighed, with these linings, 130 pounds. Directly in the center of the box were several small compartments, formed of lead and surrounded by steel, each one of the right size to admit a small glass tube containing a portion of the radium salts—the form in which the metal is handled for shipment. The lid of the mahogany box was inlaid with a gold plate, handsomely marked with the following inscription: "Presented by the President of the United States on behalf of the women of America to Madame Marie Sklodowska Curie in recognition of her transcendent service to science and humanity in the discovery of radium. The White House, May 20, 1921."

## Counting Bacteria

(*Continued from page 29*)

law. The two circuits form in the ocular field two adjacent layers which the observer equalizes by the dimming process based either on polarization phenomena produced by glass prisms, or else by the gradual displacement of a dimming plate.

In the new opacimeter the luminous source is a nitrogen lamp of 100 candlepower contained in a metallic globe, allowing light rays to pass in two rectangular directions. A lens projects a parallel pencil through two windows diametrically opposed in the side of a copper recipient full of water destined to receive the emulsion tube. On going out, the pencil, after having passed through a selective colored screen, penetrates a total-reflection prism and then forms into a lens which throws the ray upon a glass cube formed by two right-triangular prisms put together along their hypothenuses, one of which, partially silvered, throws it finally into the microscope. The other pencil of light follows through the colored screen and passing through an objective it traverses the glass cube through its non-silvered part and subsequently penetrates into the field of the ocular of the microscope. Before penetrating into the objective this luminous ray passes through a photographic plate, more or less dimmed, the intensity of darkening having been previously determined by means of spectrophotometric measures. This plate, mounted on a glass cylinder, pivots upon its center by the action of a little handle which the observer actuates from the outside, and has a photographic scale dividing its length into 100 equal parts. In addition, the characteristics of the objective have been calculated so that the image of the divisions shall be formed on the level of the silver surface of the glass cube so that it may be seen in the microscope at the same time as the limit of the two layers. The equaling of the latter and the reading of the scale is therefore made in the same field. In order that the observer be not influenced by any preconceived idea, a handle allows him to actuate a movable shutter which reveals the graded scale at the exact moment needed.

As the gradual dimness of this photographic plate or screen is measured by means of an arbitrary graduation, it is necessary to make an empirical calibration. For that purpose a curve is constructed connecting the divisions to the standard chosen as representative of bacterian substance, such as for example the *dry weight* of bacteria per cubic centimeter of emulsion.

After having taken as a standard a bacterian emulsion the same is divided in two parts. One is put inside a centrifuge apparatus and the mixture at the bottom is drawn off and washed in distilled water, when it is weighed at 110 degrees. Thus, the net weight in milligrams per cubic centimeter of standard emulsion is obtained. With the other part a series of emulsions is made up which are successively examined through the opacimeter. By using the amounts read out as abscissas and the corresponding dry weights as ordinates, the calibration curve is obtained. In the laboratory the strength of the serums is not expressed in dry weight but by *the number of bacteria* per cubic centimeter and, therefore, after having obtained the standard, microscopic counts are made by means of the Angus cell. Lastly, from time to time, the various adjustments of the apparatus are verified by means of opal-colored glass plates disposed in tubes and which are used for constant opacity tests.


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## NEW BOOKS, ETC.

THE STUDY OF CHEMICAL COMPOSITION. By Ida Freund. New York: The Macmillan Company, 1904. 8vo.; 650 pp.; illustrated.

This separate treatment of chemical composition concentrates attention upon important facts, and gives the initial discoveries and the trend of empirical knowledge. It shows that the accepted notation is independent of the ultimate constitution of matter, draws a distinct line between facts and hypotheses while emphasizing the usefulness of the latter, and elaborates selective researches that lend themselves to the illustration of various viewpoints in preference to attempting full historical detail.

THE IDYL OF THE SPLIT-BAMBOO. By George Parker Holden, M.D., F.A.C.S. Cincinnati: Stewart and Kidd Company, 1920. 8vo.; 278 pp.; illustrated.

Here is another of those delightful Stewart-Kidd books anent the art of angling. The joys of the fisherman are sympathetically drawn; there are chapters on rod-making—splitting out and assembling, tapers and plotting, gluing up and fitting; windings and guides, handgrasps and reelseats are dealt with expertly, and the reader is initiated into the home cultivation of silkworm gut, the technique of landing nets and equipment, and the features of a model angler's camp.

PRACTICAL ENGLISH FOR NEW AMERICANS. By Rose M. O'Toole. New York: D. C. Heath and Company, 1920. 8vo.; 196 pp.; illustrated.

The causes for Miss O'Toole's brilliant success as a teacher of our foreign-born are apparent in this simple reader with its carefully graded lessons. Its ultimate purpose is Americanization; the "Facts" at the end of each chapter, to be memorized, teach historical and political truths to that end. The initial sections are full of splendid suggestions to teachers, and deal with devices and methods and the conduct of factory classes.

THE BOY SCOUTS YEAR BOOK. 1920. Edited by Franklin K. Mathews. New York: D. Appleton and Company. 8vo.; 255 pp.; illustrated.

There is a bookplate with space for the owner's name, and any boy will be proud to have his name on such a book as this. He will thrill to "high adventure" in the air, yearn toward the "woodsy" cookery of Ladd Flumley, and ecstatically foHow Dr. Hornaday in the track of the great brown bears of Alaska. Dan Beard tells how to make knife scabbards and hogans. If the reader is a wireless enthusiast, or interested in popular science or in Indian lore, he will find here something about all of these things.

THE HUMAN MOTOR. Or the Scientific Foundations of Labor and Industry. By Jules Amar. D.Sc. New York: E. P. Dutton and Co., 1920. 8vo.; 309 illustrations; numerous tables.

Of late years physiological data relating to working efficiency have been steadily accumulating, and much of this accumulation is authentic and of practical help in industry. Our author, who is Director of the Research Laboratory of Industrial Labor at the *Conservatoire National des Arts et Metiers*, first summarizes general principles; his lengthy consideration of the human body as a motor and of the conditions under which it attains its highest efficiency as a working instrument is a most interesting and enlightening piece of writing. Properly understood and applied, his shrewd and representative selections from the mass of literature available should lead directly to that desired consummation, greater output with less expenditure of effort.

OLD AT FORTY OR YOUNG AT SIXTY. By Robert S. Carroll, M.D. New York: The Macmillan Company, 1920. 8vo.; 147 pp.; illustrated.

Dr. Carroll, who will be remembered as the author of several popular works on jangled nerves and their retuning, marshals such information as science and psychology offers to enable man to grow old gracefully, retaining his powers to an advanced age. His workable recommendations embrace the physical, mental and spiritual, and their adoption would without doubt bring greater comfort and satisfaction to the later years of life.

ROAMING THROUGH THE WEST INDIES. By Harry A. Franck. New York: The Century Co., 1920. 8vo.; 486 pp.; illustrated.

These sketches are the "random pickings" of an eight-months' tour of the Antilles by the observant author of "A Vagabond Journey Around the World." They are not intended as a traveler's guide, though there are many hints he might accept with benefit; their chief appeal is to those of us who do our traveling in a comfortable chair. To such the story of this extended journey will prove absorbing. The American West Indies receive closest attention, but the British and French territory is also covered with page after page of fine illustrations from the author's photographs and a map of his itinerary.

PHYSIOLOGY OF FARM ANIMALS. By T. B. Wood, C.B.E., M.A., F.R.S., and F. H. A. Marshall, Sc.D. Part I. General. By F. H. A. Marshall, Sc.D. New York: G. P. Putnam's Sons, 1920, 8vo.; 204 pp.; 105 illustrations.

Students of agriculture and veterinary students will find this an unusually good treatise on a neglected branch of physiology. The industrial importance of stock breeding and rearing is such that all resources of knowledge should be brought to bear upon them. The first volume of this work has chapters on histology, the organs of digestion, respiration and excretion, the blood, the nervous system, and so on, until we come to a very thorough and well-illustrated section on the generative organs and the mechanism of pregnancy and parturition. The second volume will deal with animal nutrition.

A THOUGHT BOOK ON THE SOCRATIC METHOD. Edited by T. Sharper Knowlson. Philadelphia: J. B. Lippincott Company. 8vo.; 200 pp.

It would be hard to conceive of a work more stimulating to thought, more helpful to close, accurate reasoning on broad subjects, than this unique offering of Mr. Knowlson's. Each page is headed by a striking quotation, provocative and intriguing; the columns below provide space for questions, answers and notes, and in half the instances several questions are provided as models. Two or more students using this text together will find many a fascinating evening in the book, and will make rapid progress in the development of their mental powers.

BUILDING THE EMERGENCY FLEET. By W. C. Mattox. Cleveland: The Penton Publishing Co., 1920. 8vo.; 279 pp.; 16 portraits; 21 illustrations; 9 charts.

The former head of the Publication Section has here set down the full story of problems met with and overcome by the Emergency Fleet Corporation, supplemented by an absorbing gallery of pictures portraying the directors of this vast undertaking, ship exteriors and interiors, launchings, and the Hog Island development. Charts show how expenditures were converted into ships, how launchings and deliveries progressed, and other comparative data of construction and costs. The volume has a dignified format, is printed on a fine quality of paper, and presents in readable form facts that all intelligent Americans should be interested in.

ELEMENTARY COURSE IN PRINTING. By Fred J. Thoren. Joliet, Ill., 905 Benton Street: The Joliet Calendar Company, 1920. 8vo.; 61 pp.; illustrated.

The author's course, developed by his experience as printing instructor in the Chicago public schools, sets forth, for the benefit of the teacher, the most approved principles of organization, instructional procedure, and equipment. Most of the text is concerned with outlining an elementary course in which the points pertaining to typesetting, composing and so forth are clearly brought out, with a tabulation of exercises, lesson-material, and layouts.

CREATIVE CHEMISTRY. By Edwin E. Slosson, M.S., Ph.D. New York: The Century Co., 1920. 8vo.; 311 pp.; illustrated.

In a most attractive form the literary editor of *The Independent* gives us the facts of recent achievements in the chemical industries. He divides human progress into three periods—the appropriative, the adaptive, and the creative, taking the last as his theme. He justifies his title, talks entertainingly of such things as feeding the soil, coal-tar colors, the rival sugars, solidified sunshine, and the products of the electric furnace, and, together with exact and edifying information, opens up magical vistas to the thoughtful reader.

TAFT PAPERS ON LEAGUE OF NATIONS. Edited by Theodore Marburg, M.A., LL.D., and Horace E. Flack, Ph.D. New York: The Macmillan Company, 1920. 8vo.; 340 pp.

As everybody knows, Mr. Taft stands for the League, and is quite as high an authority upon it as any of those arraigned against it. His Americanism cannot be questioned any more than can his legal knowledge and qualifications. These speeches and letters were made and written before the adoption of the revised Paris Covenant—with the exception of one article on the revised Covenant. Frankly asserting that, had he been a senator, he would have voted for this Covenant, "just as submitted," he blames the President for refusing to accede to reasonable modifications of Article X. Mr. Taft's interpretations and opinions should be read by all who have the good of the country and of civilization at heart; he makes the prediction that Mr. Harding will be forced to ratify the League Covenant with reservations.

THE VENTILATION HAND BOOK. By Charles L. Hubbard. New York: The Sheet Metal Publication Company, 1920. 8vo.; 231 pp.; 150 engravings.

The first edition of this hand book, with its subject-matter conveniently arranged in the form of questions and answers, was well received, and the present enlargement and revision has made of it an even better guide to good practice. It indicates the principles of ventilation as applied to furnace heating, treats of ducts, flues and dampers for gravity heating, explains fans and fan work, and concludes with a paper on the ventilation of ships.

MINERALOGY. By Edward Henry Kraus, Ph.D., Sc.D., and Walter Fred Hunt, Ph.D. New York: McGraw-Hill Book Company, 1920. 8vo.; 561 pp.; illustrated.

This new and attractive text serves as an introduction to the study of minerals and crystals, and is the fruit of long experience in teaching large classes of beginners. It compresses essentials into a single volume without sacrificing directness of treatment; instead of, or supplementing, the conventional drawings of crystals, we have a series of fine original photographs. Mineralogy is sketched in its relationship to modern civilization and to the economic production and uses of minerals. The human element is injected by means of photographs and thumb-nail biographies of distinguished mineralogists.

LESSONS IN HEAT. By Wm. S. Franklin and Barry MacNutt. Bethlehem, Pa.; Franklin and Charles, 1920. 8vo.; 147 pp.; illustrated.

The third volume in this "Lesson Series" by two experienced educators and writers deals with heat. Their methods of teaching are directed toward coupling up mathematical ideas with "actual conditions and actual things," hence their definitions while varying considerably from the classical form go to the heart of practice. This, in college and technical school, lends vitality to a course, and holds the interest of students by its direct path to real and definite knowledge and results.

ADVANCED SHOP DRAWING. By Vincent C. George, B.S. New York: McGraw-Hill Book Company, 1920. 8vo.; 147 pp.; illustrated.

By the use of this text, those who are already familiar with mechanical drawing may gain a practical knowledge of drafting as applied to various lines of engineering. Among the discussions of the book are pictorial representation, Patent Office drawings, electrical drawing, piping layouts, structural drawing and sheet metal work. Some knowledge of orthographic projection and fair facility in the use of instruments should enable the student to master the progressive lessons with little difficulty.

LEHRBUCH DER MATHEMATIK. Herausgeben von Esselborn. Erster Band: F. Meisel, H. Roth, E. H. Schütz. 8vo.; 643 pp.; 785 figures. Zweiter Band: G. Ehrig, G. Chr. Mehrtens. 8vo.; 770 pp.; 793 figures. Leipzig; Wilhelm Engelmann. 1920.

Vol. I. of this comprehensive work deals with algebra, plane and solid geometry, and perspective. Vol. II., with trigonometry, analytical geometry, differential and integral calculus and mechanics, concluding with the mechanics of construction. Like all works emanating from this house, it is a very full and careful treatment of its subject by eminently qualified teachers and illustrates its points by a profuse use of diagrammatic material. To technical students with a good knowledge of German it will be illuminating and helpful in a high degree.

HOW PAPER BOXES ARE MADE. By Robert F. Salade. Lafayette, Ind.: The Shears Publishing Company, 1920. 12mo.; 225 pp.; illustrated.

This handy little book tells the beginner how to manufacture all sorts of paper boxes; there are special instructions on the printing department, on embossing and gold-leafing, on label work, etc., with many pictures of the machinery and of the finished product.

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There is nothing spectacular about the Westinghouse space heater. It is built for service rather than for show. It is just a sturdy, dependable heating unit that can be attached to almost anything, and it makes a lot of heat at but little cost whenever the switch is snapped.

It is used for almost every heating purpose: for processes where it is desirable to attach the heater to the tank or other container; for isolated heating needs to avoid the expense of running steam lines or of erecting stoves; for incorporation into such machines as ovens and driers. Its simplicity, absolute safety, and excellence of construction make it the most satisfactory general utility heating unit ever devised.

Its construction is at once sensible and scientific. The terminals are permanently and solidly attached. The heating element is protected by heavy steel armor. Mica insulation of the best quality separates the heating element from the steel case. The element itself is of standard Westinghouse quality. The whole heater is practically indestructible, capable of years of usefulness. It is obtainable in three lengths, 12 inches, 24 inches, and 44 inches, thus affording combinations that will provide almost any quantity of heat for any situation.

It will surprise and please you to learn how many places you have in your own plant where Westinghouse space heaters will fill a long felt want. Ask any Westinghouse office.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

*Offices in all Principal Cities · Representatives Everywhere*

# Westinghouse

**ELECTRICAL APPARATUS FOR INDUSTRIAL HEATING**

# General Motors Trucks

IT is easy for the GMC organization to understand and appreciate the unusual stories of lasting quality and trouble-free operation told all over the country about GMC Trucks.

Such evidences of real quality naturally result from a product as conscientiously built as GMC Trucks.

During its experience in truck manufacture the General Motors Truck Company has proved that a reputation for building a quality product is far more valuable than the name of building to meet a price.

Behind the manufacture of GMC Trucks is the prestige of the General Motors Corporation, the largest organization in the industry, a guarantee of continued quality and permanence.

**GENERAL MOTORS TRUCK COMPANY**

*One of the Units of the General Motors Corporation*

**PONTIAC, MICHIGAN**

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